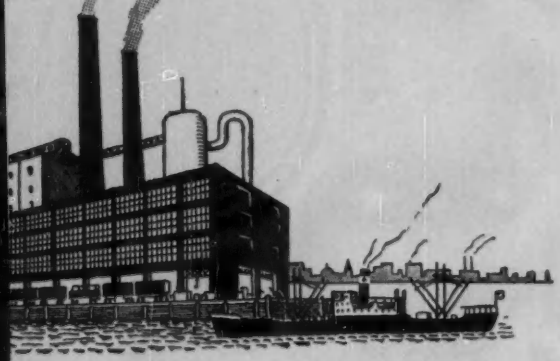
Vol. 33 No. 2
April 1957

ECONOMIC GEOGRAPHY



Clark University ∽ Worcester, Mass., U.S.A.

SUBSCRIPTION INFORMATION

ECONOMIC GEOGRAPHY is a quarterly journal published by Clark University for the benefit of geographers, economists, teachers, professional and business men, and all others who are interested in the intelligent utilization of the world's resources.

Regular subscription rates (except to charter subscribers) are $6.00 per year or $11.50 for two years (plus 50c per year for mailing charges outside the United States and its Territories and Canada) payable in full in United States dollars at Worcester, Mass.

A special rate of $3.50 per year (payable in advance in United States dollars) is available to students enrolled in universities or colleges anywhere. Student subscriptions are renewable at the same rate, but for only one year at a time. For such renewals a note from a department chairman is required, testifying to continued student status.

Single copies of back numbers beginning with Volume 30 will be sent to any American address for $1.75 each; to any foreign address for $2.25. (For all issues preceding Volume 30 the single copy cost is $1.50 domestic and $2.00 foreign.) The price for a complete set will be furnished upon request.

Subscribers are requested to send notices of change of address at least five weeks before they are to take effect. The old as well as the new address must be given.

Indexes of ECONOMIC GEOGRAPHY are issued every October for the volume just completed and are bound into the October issue. A cumulative index for volumes 1 to 25 is available (cloth covered, $5.00; paper covered, $4.00). The articles in the magazine are also indexed in the International Index to Periodicals to be found in every United States Library.

Send all subscriptions and orders to ECONOMIC GEOGRAPHY
Clark University
Worcester 10, Mass., U.S.A.

INFORMATION FOR CONTRIBUTORS

This magazine publishes articles in the field of economic geography as well as articles in adjacent fields that contribute to an understanding of the world's economic patterns.

All articles should be typed on 8½ x 11 inch paper and should be double-spaced. Authors are requested to send with each article a statement as to the field work, special experience, or other background on which the article is based. They are also urged whenever possible to submit maps and graphs in such form that they can be reproduced directly. In cases where it is necessary these will be redrawn at the editorial offices, but this may result in delay in publication. Delay will be avoided, also, if the author will send a caption with each illustration. All map or chart captions should show the source of data or other information unless this is already given in the illustrations. The sources of information for all tables, too, should be shown. Wherever a photograph is used that was not taken by the author, some source credit should appear in the caption.

A reasonable number of footnotes can be used with each article, but authors are requested to keep them to a minimum. Particularly, long informational footnotes should be avoided. All footnotes should be inserted between lines wherever they occur in the text rather than at the bottom of the page or at the end of an article.

Galley proof will ordinarily be submitted. Lengthy or unusual changes in proof will be charged to the author. An order blank for reprints will accompany the galley proof. Fifty reprints without covers will be furnished free to each author.

The originals of all illustrations will be destroyed within one month of publication unless their return has been specifically requested before that time. Authors will be billed for postage on all illustrative material returned.

All manuscripts submitted for publication and all books for review should be addressed to the Editor, ECONOMIC GEOGRAPHY, Clark University, Worcester 10, Mass., U.S.A.

ECONOMIC GEOGRAPHY

CONTENTS FOR APRIL, 1957

Some Characteristics of the Population of Cities in Similar Service Classifications . . . . . *Howard J. Nelson* 95

The Agricultural Regions of Tasmania: A Statistical Definition . *Peter Scott* 109

Observations on Land Use in Iraq . . . . . *D. Hywel Davies* 122

Commerce of the Sault Canals . . . . . *Albert G. Ballert* 135

Lorraine and the Ruhr . . . . . *N. J. G. Pounds* 149

The Retail Potential of Some Representative New Zealand Towns *L. L. Pownall* 163

Recovery of the Sugar Industry in Indonesia . . . . . *D. W. Fryer* 171

BOOK REVIEWS

J. E. Spencer: Asia East by South: A Cultural Geography *O. H. K. Spate* 182

Melvin L. Greenhut: Plant Location in Theory and Practise *H. H. McCarty* 183

Sten Sture Paterson: The Forest Area of the World and Its Potential Productivity . . . . . *A. W. Küchler* 184

Samuel Trask Dana: Forest and Range Policy: Its Development in the United States . . . . . *Wesley Calef* 184

Ruben L. Parson: Conserving American Resources . *J. Granville Jensen* 185

Oxford Regional Economic Atlas: The U.S.S.R. and Eastern Europe *George Kish* 186

Shannon McCune: Korea's Heritage, A Regional and Social Geography *George B. Cressey* 186

Local Accessibility (The Hinterlands of Towns and other Centres as determined by an analysis of bus services) . . . . . *J. E. Vance, Jr.* 187

CORRESPONDENCE

Howard G. Roepke: To the Editor 188

The editors and the University assume no responsibility for statements and opinions expressed by contributors

ECONOMIC GEOGRAPHY

Editorial and Business Offices: 950 Main Street, Worcester, Mass.

Published Quarterly at
Commonwealth Press, 44 Portland Street, Worcester, Mass.

PRICE, $1.75 THE CURRENT NUMBER SIX DOLLARS A YEAR
(except for charter subscribers)

Entered as second class matter at the Post Office at Worcester, Mass.
under the Act of August 24, 1912

Copyright 1957 by Clark University, Worcester, Massachusetts

THE FUTURE

Among forthcoming articles are:

Putting the "Economic" into Economic Geography . . . . *Maurice B. Ballabon*

The Age Structure of New Zealand's North Island Communities . *S. H. Franklin*

Some Recent Changes in the Coal Mining Industry of the Bituminous Coal Fields of Pennsylvania . . . . . *George F. Deasy and Phyllis R. Griess*

Megalopolis: Or the Urbanization of the Northeastern Seaboard . *Jean Gottmann*

Some Geographic Aspects of International Trade . . *Andreas and Lois Grotewold*

Water Legislation . . . . . *Edward Hamming*

Lourenço Marques in Delagoa Bay . *William A. Hance and Irene S. van Dongen*

Iron Mining Industry in Singbhum-Mayurbhanj Region of India
Pradyumna P. Karan

Igusa: A Critical Cash Crop in the Rural Economy of Okayama Prefecture
Curtis A. Manchester

Banana Industry of Ecuador . . . . . *James J. Parsons*

Principles of Areal Functional Organization in Regional Human Geography
Allen K. Philbrick

Changing Pattern of Norwegian Hydroelectric Development
William Lindsay Raitt

Geography of Tourism in Corsica . . . . . *G. W. Robinson*

Recent Trends and Developments in the British Coal Mining Industry
Trevor M. Thomas

Urban Agriculture in Southern Japan . . . . . *John H. Thompson*

Railway Traffic and Agriculture in New Zealand . . . . . *William H. Wallace*

Hambegamuwa Village: An Example of Rural Settlement in Ceylon's Dry Zone
R. Wikkramatileke

The Papaloapan Project: An Experiment in Tropical Development
William W. Winnie, Jr.

* * * * *

And book reviews by carefully selected reviewers.

ECONOMIC GEOGRAPHY

VOL. 33 APRIL, 1957 No. 2

SOME CHARACTERISTICS OF THE POPULATION OF CITIES IN SIMILAR SERVICE CLASSIFICATIONS

Howard J. Nelson

Dr. Nelson is an Assistant Professor in the Department of Geography of the University of California at Los Angeles.

GEOGRAPHERS and other students of cities on several occasions have classified the urban centers of the United States according to their major services or dominant function. The knowledge that Kannapolis, North Carolina, has manufacturing employment of unusual proportions, that Conneaut, Ohio, is high in transportation and communication service, or that Warrington, Florida, has an abnormally large proportion of its labor force working in public service has utility of itself. For example, *The Municipal Yearbook* for almost a dozen years has included an economic classification of cities as general urban reference material.

However, in the author's opinion, the major value of urban classification is not its usefulness as a reference tool. Rather it is in the utilization of a classification for further and more penetrating analyses of urban areas. For example, studies of the social and economic characteristics of the population of our cities are now susceptible to much needed refinement. Little has been attempted in the past in this direction. Analyses have been made of population change, age, educational attainment, labor force participation, and so on, of the urban population in general.[1] But slight progress has been made in investigating the possible variation of items of this sort among cities of different functions or service classifications. The aim of the first portion of this article is to investigate the possibility of such correlations.

Geographers, accustomed to thinking in terms of regional differentiation, may not be completely satisfied with the above analysis. For them a further question remains: How does *location* affect the social and economic characteristics of cities in similar service classifications? An attempt has been made in the second part of the article to find some tentative answers to this regional question.

PROCEDURE

A classification worked out by the author and published as "A Service Classification of American Cities,"[2] forms the basis of this experiment. Space prohibits a general summary here and

[1] For one recent example see Donald J. Bogue: "Urbanism in the United States, 1950," *Amer. Journ. of Sociol.*, Vol. 60, 1955, pp. 471–486.

[2] Howard J. Nelson: "A Service Classification of American Cities," *Econ. Geog.*, Vol. 31, 1955, pp. 189–210.

TABLE I

SERVICE GROUPS CLASSIFICATION BASED ON STANDARD DEVIATIONS

	Plus 2SD	*Plus 3SD*
Manufacturing	Mf2	Mf3
Retail trade	R2	R3
Professional service	Pf2	Pf3
Transportation and communication	T2	T3
Personal service	Ps2	Ps3
Public administration	Pb2	Pb3
Wholesale trade	W2	W3
Finance, insurance and real estate	F2	F3
Mining	Mi2	Mi3

the reader is referred to the original article. It need only be said that from material in the 1950 Census of Population 897 urban areas of over 10,000 population were classified according to concentrations of employment into nine service groups (Table I).

Concentrations were recognized if they were one or more Standard Deviations from an established national mean of employment in the various fields of service. Cities not high in any service were grouped together under a Diversified class. A city could have recognized concentrations in more than one service.

The 1950 Census of Population has available (Table 35, Vol. 2) for the same 897 urban centers, a number of items of information about the population and labor force. From the census the following seven categories, important in the better understanding of cities, were chosen for investigation:

1. Percentage increase in population, 1940–50.
2. Proportion of the population 65 years old or over.
3. Average number of school years completed, persons 25 years old or older.
4. Participation in the labor force—per cent of total males, 14 years old or older, actually employed.
5. Participation in the labor force—per cent of total females, 14 years old or older, actually employed.
6. Per cent unemployed—census week (April, 1950).
7. Median income in 1949.

Statistics were compiled for each of the 897 cities under study in each of the above seven categories.[3] Two simple approaches were used in an attempt to interpret the statistics—means and extremes. First, averages were computed for each category in all of the SD3 and SD2 cities for each of the 9 service classifications. Only SD3 and SD2 cities were used in the averaging, instead of all of the cities in each class, in an attempt to restrict consideration to urban areas where each service was heavily concentrated and thus would be most likely to affect the characteristics of the cities. The results of these computations appear as Table II in this article.

In the thought that extremes may also be revealing, the ten highest and the ten lowest cities (using the entire group of 897 cities) in each of the seven categories were noted and will be used, as appropriate, for illustrations. All cities that lost population and all cities that increased by 100 per cent or more in the 1940–50 decade were also recognized for illustrative purposes.

MANUFACTURING CITIES

The 30 cities classified Mf3 or Mf2, when compared to other classes of cities, have three of the highest and two of the lowest averages in the seven categories investigated, confirming the distinctiveness of the group (Table II).

On the average, cities with an extreme concentration of manufacturing changed

[3] It is difficult to secure comparable data on population change. Data on percentage change in population is nonexistent for the 157 Urban Areas—divisions used where available in the Service Classification—as they are new census units, formed only in 1950. For these 157 places percentage change in population for Standard Metropolitan Areas, a slightly larger census unit, was substituted.

TABLE II

AVERAGES OF SELECTED CRITERIA FOR ALL CITIES AND FOR ALL SD3 AND SD2 CITIES

	All cities	*Mf3 & Mf2*	*R3 & R2*	*Pf3 & Pf2*	*T3 & T2*	*Mi3 & Mi2*	*Pb3 & Pb2*	*Ps3 & Ps2*	*W3 & W2*	*F3 & F2*
Percentage increase in population, 1940–50	27.9	2.2	39.4	65.0	17.5	31.1	40.0	61.0	30.4	35.6
Per cent 65 years old or older	8.6	7.6	9.0	7.6	9.7	7.4	7.3	9.2	7.7	10.0
Average years of school completed	10.0	8.9	10.5	12.3	10.4	9.7	10.8	11.0	9.9	11.1
Participation in labor force, per cent of males	77.8	82.8	77.1	55.8	78.0	79.2	77.8	73.2	80.0	75.6
Participation in labor force, per cent of females	32.8	35.9	30.3	34.1	29.2	27.1	33.0	33.3	33.0	34.6
Per cent unemployed	5.1	5.4	6.7	3.6	4.7	5.5	4.7	5.8	6.9	4.1
Median income	$2,643	$3,134	$2,560	$1,674	$2,733	$2,822	$2,658	$2,227	$2,566	$2,780
Number of cities	897	30	27	39	50	34	41	36	36	35

Source: Compiled from Table 35, Vol. 2, Census of Population, 1950.

little in population during the 1940–50 decade, increasing an average of only 2.2 per cent, compared to the average of all cities of 27.9 per cent. In fact, not one of the manufacturing cities here considered gained as much as 20 per cent in population while eight of the group lost population. (But comparable data are available for only 20 of the 30 cities. Others include unincorporated areas such as Richland, Washington, Mf2, a creation of the decade, and cities newly incorporated since 1940, such as Weirton, West Virginia, Mf2.)

The proportion of the population over 14 years of age, both male and female, in the labor force in the Mf3 and Mf2 cities, is greater than that of the cities of any other class—almost 83 per cent of the men and about 36 per cent of the women are workers. The extreme is Richland, Washington (Mf2), which has a larger percentage of its men working than any other city in the country—91.4 per cent.

With average earnings of $3134, Mf3 and Mf2 cities are strikingly ahead of cities in other classes. The next highest class, mining cities, runs a rather poor second with $2822. Once again Richland, Washington (Mf2), heads the list with $4629. In fact, five of the ten cities highest in average earnings are manufacturing cities.

In spite of their high earnings, the people of these 30 cities have the lowest average number of years of school completed, 8.9—almost a year under the next lowest class—and a difference of nearly 3.5 years from the highest group, professional service cities. However, none of the manufacturing cities appears in the list of the ten lowest in educational achievement.

Manufacturing cities have generally a lower percentage of persons 65 and over than the average city, and in April, 1950, had a slightly larger percentage of unemployed than the average city. The city with lowest rate of unemployment in the country was Two Rivers, Wisconsin (Mf2), with 0.9 per cent unemployed.

Because of the large proportion of the labor force that must be employed in manufacturing (43.11 per cent), before a city receives even an Mf classification, it is valid to include all of the 153 cities of the Mf group in a similar calculation. This has been done in Table III. Though the individual percentages are changed somewhat, all of the above major generalizations are still possible, lending additional weight to their validity.

RETAIL TRADE

Twenty-seven cities belong to either the R3 or R2 category. None of their averages is the highest or the lowest in the group, and the averages are usually not too far from the national mean. These retail cities grew an average of almost 40 per cent, one of the 27 cities lost population; none gained as much as 100 per cent in the last decade.

Retail cities have slightly more than the national average of persons 65 years old or older, and the city with the largest proportion of elderly population in the United States, Lake Worth, Florida (R2F2Ps), with 21.5 per cent of the population 65 or over, belongs at least partially to this group.

In the proportion of either males or females in the labor force, retail cities are under the national average. This is also true of average earnings.

The percentage of unemployed is somewhat above the national average, 6.7 per cent as compared to 5.1 per cent. Four retail cities are among the ten cities with the highest proportion of unemployed in the nation: Madera, California (R2), with 15.9 per cent unemployed; Tulare, California (R3W), 15.3 per cent; Blytheville, Arkansas (R2Ps), 14.8 per cent; and Hanford, California (R3), 14.6 per cent.

PROFESSIONAL SERVICE

In five out of the seven categories under discussion professional service cities register the highest and the lowest figures. They thus share with manufacturing cities the distinction of being the most "extreme." However, in the case of professional service cities considerable significance is lost in the comparison because of the difficulty of interpreting the census data. In 1950 for the first time college students were considered as residents of the city in which they were attending classes. As a large number of professional service cities are the locations of colleges and universities with large enrollments the new census procedure has a direct bearing on their reported populations. Also, as students are a specialized group, their presence imparts unique characteristics to the cities involved.

TABLE III

AVERAGES OF SELECTED CRITERIA FOR MANUFACTURING CITIES

	All cities	*Mf3 & Mf2*	*All Mfg.*
Percentage increase in population, 1940–50	27.9	2.2	14.4
Per cent 65 years old or older	8.6	7.6	8.5
Average years of school completed	10.0	8.9	9.6
Participation in labor force, per cent of males	77.8	82.8	84.3
Participation in labor force, per cent of females	32.8	35.9	35.7
Per cent unemployed	5.1	5.4	5.1
Median income	$2,643	$3,134	$3,139
Number of cities	897	30	183

Source: Compiled from Table 35, Vol. 2, Census of Population, 1950.

Professional service cities grew an average of 65 per cent in the last census decade—the largest proportion of any class of city. A good deal of this growth, however, may be attributed to the newly counted students. Nine out of the 39 Pf3 and Pf2 cities show apparent increases of more than 100 per cent. None has registered a decline.

In average number of years of school completed, understandably, the Pf3 and Pf2 cities are the highest of the groups, averaging 12.3 years. In fact, all ten cities with the highest average schooling belong to the Pf3 and Pf2 class. State College, Pennsylvania (Pf3Ps), 14.8 years; West Lafayette, Indiana (Pf3Ps), 14.6 years; and Pullman, Washington (Pf3Ps), 14.2 years—lead the list.

The student component, too, reduces the proportion of males participating in the labor force to an unusual figure,

55.8 per cent, nearly 20 per cent lower than any other group average. The lowest nine cities in the United States in this category are professional service cities. Princeton, New Jersey (Pf3), with 39 per cent has the lowest figure, and is the only city where a larger proportion of the females than the males are in the labor force.

The proportion of persons 65 and over is relatively low, but not at a record figure. Willow Run, Michigan (Pf2), however, with less than 1 per cent of its inhabitants over 65 has the lowest figure for any city in the country. (This unusual urbanized area in 1950 consisted essentially of a veterans' housing project in which a portion of its residents were students at the nearby University of Michigan). On the other hand, Fulton, Missouri (Pf3), and Jacksonville, Illinois (Pf3), cities without large college enrollments, are in the highest ten, with 16.5 and 15.9 per cent over 65 respectively.

Professional cities have the lowest average unemployment of any of the service groups, and three cities are in the lowest group of ten.

Average earnings, also, are the lowest of any category, with an average of only $1674. All of the ten lowest cities belong to the professional service group, with State College, Pennsylvania (Pf3Ps), the city where professional service is the most concentrated, at the bottom, with $824. Presumably this is tied up with the many part time and unskilled jobs available in a college community.

TRANSPORTATION AND COMMUNICATION CITIES

Although the average percentages of the 50 cities receiving a T3 or a T2 classification are not the highest or lowest in any category, these transportation and communication cities are not without distinction.

Growth during the last census decade has been relatively small. Only manufacturing cities have grown less than the 17.5 per cent that is the average of this group. Eleven of the T3 and T2 cities actually lost population, while two increased more than 100 per cent. These are Pasco, Washington (T2) (the scene of the Northern Pacific's new classification yard and a transportation center of the Columbia River Basin), which increased 161.4 per cent; and Kingsville, Texas (T2), 117.1 per cent.

Transportation cities have a larger than average proportion of old people. The group is second only to mining in the proportion 65 and over, some 9.7 per cent as compared to a national average of 8.6 per cent. Two cities in the top ten in this respect are from the transportation and communication group: Moberly, Missouri (T3), 15.1 per cent, and Boone, Iowa (T3), 15.0 per cent.

The proportion of males in the labor force is slightly above the average city, and, as transportation is not a field offering many opportunities for female employment, the average proportion of women in the labor force is very low, 29.2 per cent, as compared to an average, 32.8 per cent: only mining is lower. Boone, Iowa (T3), is found among the lowest ten cities with only 22.2 per cent of its females in the labor force.

MINING CITIES

Understandably, the handling of coal, oil, or ore does not offer much of an opportunity for women workers. Generally speaking, the 34 cities with a Mi3 or Mi2 classification have at least one common characteristic—the proportion of females in the labor force is low—only 27.1 per cent, the lowest of any of the service classes of cities. Five cities in the lowest ten are mining cities, with coal, oil and iron ore all represented.

Other characteristics, however, seem

to be correlated to the mineral mined, particularly whether coal or oil is the product. When all the cities are averaged together, much of what is distinctive is canceled out. Averages were taken for the 17 coal mining cities and the 12 oil producing centers separately. The effects of the changing use patterns of these two fuels during the last decade are clearly reflected in the results.

Eleven of the 17 coal mining centers lost population, including all eight mining cities of the Mi3 and Mi2 group located in the anthracite region. In contrast, all 12 oil centers gained in the 1949–50 period. The average gain was 88 per cent. Four of the 12 cities more than doubled in size and two increased over 200 per cent: Snyder, Texas (Mi3), 214.8 per cent, and Odessa, Texas (Mi3), 208.1 per cent. The oil cities have only 4.8 per cent of their population 65 or over, an extremely low percentage, while the coal cities' average is 8.9, a fraction above the national mean.

The proportion of males in the labor force is below average, 74.9 per cent in the coal mining towns and very high, 84.4 per cent, in the oil centers.

On the average, it is much more profitable to work in oil centers than in coal mining towns. The 17 oil centers have an average income of $3216, higher than any entire class, while the coal cities average of $2468 is below par. Unemployment also exhibits a contrast from one type of mining city to another. The coal mining cities have an average of 6.7 per cent unemployed, above an average figure; oil centers, 4.3 per cent, below the national mean.

PUBLIC ADMINISTRATION

The 41 public administration cities with Pb3 or Pb2 classifications can be divided into two general groups—16 capital cities, and 25 other cities, mainly urban centers near military establishments. Reflecting the increase in the complexity of government and the growth of the military establishment, both groups of cities have registered population increases in the past census decade. The capitals increased 27 per cent, but the 25 non-capital cities grew almost twice as fast with approximately a 50 per cent increase. Four public administration cities increased over 100 per cent, all belong to the non-capital group: Oxnard, California (Pb3W2), 153.2 per cent; Panama City, Florida (Pb), 122.3 per cent; Albuquerque, New Mexico (Pb2PsF), 109.9 per cent; and Key West, Florida (Pb3Ps), 104.5 per cent. (For two Pb3 cities, Warrington, Florida, and Brownsville-Brent-Goulding, no information was available in 1940 so no comparisons can be made.)

If all the Pb3 and Pb2 cities are taken together, they have the smallest proportion of persons 65 or over of any group of cities—7.3 per cent. However, the 25 non-capital cities, with an average figure of 6.9 per cent, are the outstanding segment in their lack of old people.

The 16 capitals have a high average number of school years completed—11.2, second only to professional service cities. The other 25 Pb3 and Pb2 cities are above average but not significantly so.

The proportion of the males in the labor force is not distinctive in public administration cities. However, female file clerks and secretaries bring up the proportion of women in the labor force for the 16 capital cities to 37.3 per cent, a higher percentage than for any other entire group, even higher than the average for manufacturing cities. The non-capitals, on the other hand, are slightly lower than the average city in this measure. Key West, Florida (Pb3Ps), with only 19.2 per cent of its female population in the labor force is the second lowest city in the country in this quality.

The 16 capitals have a relatively high average income—$2810, considerably above average, actually, second only to manufacturing cities. Non-capital cities, on the other hand, are lower than average. The capitals, too, exhibiting the stability of governmental employment, have relatively few people unemployed being second only to professional service cities. Other public administration cities are slightly above average in this measure.

PERSONAL SERVICE CITIES

Cities high in personal service tend to be those that attract a transient or semi-transient population, and thus, in the Ps3 and Ps2 range, they consist mostly of resort and retirement towns. Personal service cities probably have had a greater actual increase in population than cities in any other category. Statistically they are second to professional service cities, but, as has been pointed out, data for the last-named class is misleading. The 36 cities classified Ps3 or Ps2 increased by an average of 61 per cent, or more than double the national average of 27.9 per cent. None lost population. The gain for Atlantic City (Ps3R) of only 6.7 per cent was low for the group. Five of the 36 cities have more than doubled their population in the last decade. Las Vegas, Nevada (Ps3), with a 10-year increase of 192.4 per cent, is high for the group.

The proportion 65 years old or over is higher than average. St. Petersburg, Florida (Ps2F2R), with 21.1 per cent 65 years old or older, and Santa Cruz, California (Ps2RF), 20.6 per cent, are the second and third "oldest" cities in the nation.

Again, if professional service cities are omitted because of comparison difficulties, the Ps3 and Ps2 cities have a lower average percentage of their men in the labor force than any other group, (73.2 per cent compared to 77.8 per cent national average), a not unexpected situation in resort and retirement towns. However, these cities provide employment for a larger than average proportion of the cities' women.

Unemployment is a bit higher than the average. Average earnings are low—it is only the professional service cities with their college student part-time workers that keep this group from recording the lowest figure by this measure.

WHOLESALING CITIES

The 36 cities classified as W3 or W2 generally belong to the group of cities that assemble agricultural produce for shipment from the area. In these relatively small cities, growth has been about average, some 30.4 per cent.

Wholesale cities distinguish themselves in only one item—they have the highest average amount of unemployment of any group of cities, 6.9 per cent. (If the W3 cities are taken separately, it is even worse—9.6 per cent.) One wholesaling city, Brawley, California (W3), 14.6 per cent, is among the poorest 10 cities in this respect. On the other hand, Dodge City, Kansas (W2R2T), is in the best 10 cities by this measure, with only 1.4 per cent unemployed.

The average number of school years completed is not far from the national average, but four cities of these 36 are in the bottom ten, with San Benito, Texas (W3), the lowest in the country, having an average of only 5.0 years.

The proportion of people 65 and over is quite low, and the average wage is also. Both men and women are in the labor force in somewhat larger percentages than on the average.

FINANCE, INSURANCE, AND REAL ESTATE

The 35 cities in the F3 and F2 group include mainly insurance centers and a

few cities, particularly in Florida, where the real estate business is significant. But in the list also are some very large cities with a wide variety of employment coming under this heading.

The rate of growth of these cities is not far from the average, and the proportion of men and women in the labor force shows little distinctiveness. However, this group of cities has the highest proportion of those 65 and over of any group, 10.0 per cent and five finance, insurance, and real estate cities are in the list of the top ten.

This group is also distinct in that average number of school years completed is high, 11.1, and that the proportion of unemployed is low, the second lowest of all the groups. Decatur, Georgia (F3W), with 1.2 per cent out of work is the next to the lowest city in the nation in this quality.

SOME GENERALIZATIONS

It is evident that variations in economic and social qualities of American cities are, in part at least, correlated with the function or service class to which a city belongs. From the seven categories investigated in the preceding sections, generalizations like the following can be made.

Variations in the rate of change in population in the 1940–50 decade were strongly affected by a city's major service. The population in personal service and professional service cities increased by more than double the average rate (though for professional service cities the increase may be more apparent than real). Generally public service cities, particularly those in the non-capital group, increased at faster than the usual rate, as did retailing cities. However, the average manufacturing city increased least of all, almost standing still, while transportation and communication cities increased at a rate significantly lower than the national mean.

The average proportion of persons 65 years old and over is relatively uniform in American cities of whatever service classification. However, financial cities and transportation centers have slightly more than the average number of persons 65 and over, whereas public service cities, especially those of the non-capital group, have the lowest average percentage. In addition, professional service cities, manufacturing cities, and even wholesaling cities have a smaller than average proportion.

The average number of school years completed varies by almost three and one-half years among cities of the various service classes. Professional service cities lead, with a high of 12.3 years, but financial and personal cities are also above average. Manufacturing cities are low, with the average a full year under the cities of any other service group—8.9 years.

The proportion of males in the labor force ranges from about 56 to 83 per cent, depending on the type of city under consideration. Professional service cities have an extremely low percentage, 55.8 compared to the average of 77.8 per cent. Other groups vary much less from the mean, though personal service cities are rather low—73.2 per cent, and manufacturing cities are the highest of all, with an average of 83 per cent of their men over 14 employed.

The average percentage of females in the labor force, 32.8, is less than half that of the males, and it also varies proportionally less from the mean. Mining cities are significantly low, 27.1, and transportation cities are also below normal. Manufacturing cities, on the other hand, are high, but only three percentage points above the average.

Unemployment, measured in the cen-

sus week in April, 1950, was far from uniform in the cities of the various service classifications. Wholesaling cities, averaging 7 per cent, are high, but mining cities and retail cities are not far behind. Financial centers are low in this criteria with an average of only 4.1 per cent unemployed.

One of the most important measures of city well-being, average income, exhibits variations second only in magnitude, to change in population among the nine service classes. Manufacturing cities are way out in front, with an overall average of $3140, while professional service cities are the lowest of the groups, averaging only $1671. Personal service cities are also notably low, while the other six classes are considerably nearer the mean.

REGIONAL VARIATION

As has been seen, cities in one service class vary considerably from those of another class in numerous instances and in important ways. But still the geographic question remains unanswered: How does regional location affect the general social and economic characteristics of cities in similar service classifications? In an attempt to satisfy normal geographic curiosity a simple procedure was devised (after considerable experiment) to try to shed some light on the above question.

The same 897 urban areas of over 10,000 population (used throughout the study) were divided according to their location in one of the four major census regions: West, North Central, Northeast, and South. Averages were computed for the same seven categories as before for all the cities in each region. The results appear as column 1, Table IV. These regional averages were compared with the United States averages and the variations above or below the national mean indicated by (–) if below and (+) if above. A (0) indicates no variation.

Averages were also found for the SD3 and SC2 cities in each service classification (except for manufacturing where all cities were used as explained previously) in each of the four census regions. These averages appear in columns 2 to 9 in Table IV, with variations from the averages of the same service class of cities in the entire United States indicated by the symbols noted above. (Mining cities, because of the close correlation of characteristics to the type of mineral extracted, were not computed separately.)

The importance of regional location is evident from a casual inspection of Table IV. The general characteristics of a region tend to be impressed on all classes of cities within an area—without, however, obliterating variations attributable to the service class. An analysis of the four regions follows.

WEST

The West's general regional characteristics are strongly impressed on all classes of cities within the area, although variations attributable to service do remain. For five out of the seven categories, however, population change, proportion 65 and over, number of school years completed, proportion unemployed, and average earnings, the West's characteristics—above or below the national average—are reflected in the cities of each service group within the region, almost without exception.

For example, the West's cities in general have experienced rapid growth. In all but one of the eight service classifications, the average growth of the cities in the West has been faster than the national mean for cities in the respective classification. The exception is professional service cities. The eight western representatives increased by half

TABLE IV

AVERAGES OF SELECTED CRITERIA FOR ALL CITIES, AND SD3 AND SD2 CITIES IN THE UNITED STATES, AND BY CENSUS REGION

	All cities	*All mfg. cities*	*R_3 & R_2 cities*	*Pf_3 & Pf_2 cities*	*T_3 & T_2 cities*	*Ps_3 & Ps_2 cities*	*Pb_3 & Ph_2 cities*	*W_3 & W_2 cities*	*F_3 & F_2 cities*	
Per cent increase in population	27.9	14.4	39.4	65.0	17.5	61.0	40.0	30.4	35.6	
Per cent 65 years old or older	8.6	8.5	9.0	7.6	9.7	9.2	7.3	7.7	10.0	
Years of school completed	10.0	9.6	10.5	12.3	10.4	11.0	10.8	9.9	11.1	U.
Per cent males in labor force	77.8	84.3	77.1	55.8	78.0	73.2	77.8	80.0	75.6	S.
Per cent females in labor force	32.8	35.7	30.3	34.1	29.2	33.3	33.0	33.1	34.6	A.
Per cent unemployed	5.1	5.1	6.7	3.6	4.7	5.8	4.7	6.9	4.1	
Average earnings	$2,643	$3,139	$2,560	$1,674	$2,733	$2,227	$2,658	$2,566	$2,780	
Number of cities	897	183	27	39	50	36	41	36	35	
Per cent increase in population	+ 50.8	+ 43.9	+ 57.4	− 48.8	+ 56.3	+ 65.9	+ 60.3	+ 37.7	+ 60.8	
Per cent 65 years old or older	− 8.5	− 6.0	− 7.8	− 7.5	− 6.7	− 8.8	− 6.8	− 6.6	− 9.4	
Years school completed	+ 11.3	+ 10.8	+ 10.6	+ 12.8	+ 11.3	+ 11.7	+ 11.4	+ 10.5	+ 12.1	W
Per cent males in labor force	− 77.5	+ 84.6	− 77.0	+ 58.8	+ 79.5	− 71.4	− 77.5	+ 82.1	+ 78.6	E
Per cent females in labor force	− 31.5	− 29.2	+ 30.9	− 33.2	+ 30.3	− 33.2	− 32.9	+ 34.0	− 33.9	S
Per cent unemployed	+ 7.3	+ 5.9	+ 10.0	+ 4.8	+ 6.8	+ 7.7	+ 6.0	+ 10.2	+ 5.7	T
Average earnings	+ $2,980	+ $3,579	+ $2,866	+ $1,888	+ $3,102	+ $2,422	+ $2,996	+ $2,977	+ $3,181	
Number of cities	125	7	9	8	9	12	12	13	6	
Per cent increase in population	− 16.3	+ 44.5	− 29.1	+ 70.0	− 5.6	− 40.6	− 29.9	− 17.9	− 12.1	
Per cent 65 years old or older	+ 9.8	+ 8.7	0 9.0	+ 8.2	+ 11.1	+ 9.3	+ 8.4	+ 9.4	+ 10.4	N
Years school completed	+ 10.3	+ 10.0	− 11.0	0 12.3	− 10.1	+ 11.9	+ 10.9	− 10.7	− 10.7	O
Per cent males in labor force	+ 78.0	− 83.3	+ 79.2	+ 57.2	− 77.5	+ 76.4	− 72.4	+ 78.3	+ 77.6	R
Per cent females in labor force	− 31.5	− 31.5	+ 30.9	+ 34.2	+ 28.3	− 35.3	0 33.0	− 32.0	− 34.3	T
Per cent unemployed	− 3.8	− 3.8	+ 3.5	− 3.3	− 3.6	+ 3.8	− 3.6	+ 3.3	− 3.0	H
Average earnings	+ $2,790	+ $3,201	− $2,654	+ $1,733	+ $2,746	+ $2,622	− $2,503	+ $2,685	+ $2,864	
Number of cities	288	63	9	19	24	3	6	12	13	C
Per cent increase in population	− 7.1	− 5.4	− 26.0	+ 73.7	− 0.8	− 12.1	− 16.8	− 4.7	− 11.9	E
Per cent 65 years old or older	+ 9.7	+ 9.2	+ 9.6	− 7.4	+ 11.2	+ 11.2	+ 9.4	+ 11.0	− 9.4	N
Years school completed	− 9.7	− 9.0	− 10.2	− 12.2	− 10.3	− 9.8	− 10.4	− 9.4	− 10.2	T
Per cent males in labor force	− 77.6	− 80.1	+ 77.5	− 47.5	− 76.3	+ 77.0	+ 78.8	− 77.7	+ 80.1	R
Per cent females in labor force	+ 33.6	+ 35.9	+ 31.8	+ 35.3	− 28.5	+ 33.2	0 33.0	− 26.5	+ 36.3	A
Per cent unemployed	+ 5.9	+ 5.8	− 5.6	+ 4.5	− 5.7	+ 7.1	− 4.1	+ 9.7	+ 5.9	L
Average earnings	+ $2,795	− $2,943	+ $2,979	− $1,646	+ $2,571	+ $2,258	+ $2,712	+ $2,711	+ $3,044	
Number of cities	185	88	2	4	5	3	8	1	3	
Per cent increase in population	+ 41.9	+ 14.8	+ 39.7	+ 94.6	+ 19.7	+ 69.2	+ 43.5	+ 39.1	+ 52.6	
Per cent 65 years old or older	− 6.9	− 4.8	+ 10.4	− 6.1	− 8.3	− 9.1	− 6.2	− 6.0	0 10.0	
Years of school completed	− 9.6	− 8.7	− 10.1	− 12.2	− 9.5	− 10.7	− 10.4	− 8.2	0 11.1	S
Per cent males in labor force	+ 78.4	− 83.4	− 74.5	− 53.6	+ 78.1	+ 73.3	+ 79.7	− 79.5	− 74.2	O
Per cent females in labor force	+ 34.5	+ 41.5	+ 31.3	+ 34.2	+ 30.2	+ 33.6	0 33.0	+ 34.1	+ 34.7	U
Per cent unemployed	0 5.1	− 4.4	− 6.0	− 2.6	+ 4.8	− 4.6	− 4.6	− 6.8	− 4.0	T
Average earnings	− $2,260	− $2,811	− $1,984	− $1,318	− $2,418	− $2,026	− $2,421	− $1,886	− $2,449	H
Number of cities	299	25	7	8	12	18	15	10	13	

Source: Compiled from Table 35, Vol. 2, Census of Population, 1950.

again over the 1940 population, but failed to reach the national rate of 65 per cent. The region's influence is well illustrated by manufacturing cities, which grew very little on a nationwide average but increased by about 44 per cent in the West. But variations among cities of different services remain—wholesale cities, for example, increased 37.7 per cent in the area while personal service cities led the regional growth with 65.9 per cent.

Not one single exception to the regional trend occurred in four categories. The region is slightly below average in the proportion of its population 65 and over, and every class of city in the West is also below the national average for its classification. The area is above average in the proportion of persons unemployed, and every group of Western cities with similar services is also above the respective national average. Wholesale cities generally, have the highest unemployment, and as would be expected from the regional trend, the 12 wholesale cities in the West have an average of 10.2 per cent unemployed, a record high. Again, the area is above the national mean in average earnings and every class of city has above average earnings. Manufacturing cities, which have the biggest earnings of any service classification, reach, as might be expected, their peak in the West, with a seven-city average of $3579. In the average number of years of school completed, the West is above the mean, a full year higher than any other region, and every class of city is above the national average for their respective groups.

The proportion of the West's men and women that are in the labor force is slightly under the national average. Here the cities in the various service classes follow the regional trend in five cases out of eight, in the case of the females, but vary from it in five instances in the male averages. All told, however, the West is an excellent example of strong regional character and its influence on cities of all service classifications.

North Central

The cities of the North Central section of the United States are not characterized by quite as strong regional qualities in the seven categories under discussion as the cities of the West. Nevertheless, the increase in population of the North Central cities was less than the national average, the proportion 65 years old or more was greater than the United States mean, the percentage of unemployed was less than the country's average, and the average income was above the national mean. These regional qualities were readily apparent in the cities of almost every service class.

North Central cities, on the average, increased only 16.3 per cent in the 1940–50 decade, compared to a national average of 27.9 per cent, and all classes of cities in the region gained less than their respective national averages with two exceptions: professional service cities and manufacturing cities. The increase in population of the manufacturing cities in the area is really exceptional, 44.5 per cent, the highest of that class in any region, including the West and South where generally large population gains were registered.

The area has a higher than average percentage of persons 65 years old or older and this is reflected in higher than average percentages (or in one instance, the same percentage) for all of the eight classes of cities, without exception.

Unemployment is lower in the North Central section than the average for the country. Again, in every class of city in this area, unemployment is lower than the national average, and it never rises above 3.8 per cent.

Similarly, earnings in the region are

above average and in seven out of eight classes of cities in the area average earnings are higher than the national mean of the group.

In the three remaining categories the regional reflection is not quite so uniform, but it is still significant. The North Central area is above average in years of school completed, and in five of the service classes of cities in the region the average is above the national mean and in one class it is the same figure. The region is slightly above average in males and below average in females in the labor force. Cities of the various service classes follow the regional lead in about 50 per cent of the cases.

NORTHEAST

In the Northeast, as in the North Central area, cities in similar service classes tend to be strongly influenced by regional trends, but do not conform to them with quite the unanimity of those in the West. Nevertheless, in five of the seven categories under observation, only one or two service classes fail to follow the regional trend.

The growth of Northeast cities in general was considerably below the United States average, and for all classes of cities save one the average growth was far below the national average for each group. The Pf3 and Pf2 cities in the area (there are only four of them) gained an apparent 73.7 per cent, somewhat more than the national average for that group and almost three times the next highest figure.

Then, too, the cities of the area have an average below the national mean in number of school years completed. Though the various service classes vary from a low of 9.0 to a high of 12.2 years, in every instance the figure is below the average for the respective service class of city.

The cities of the Northeast are characterized by above-average figures for the proportion 65 and over, the percentages of their women in the labor force, and the number unemployed. Generally, cities in all service classes agree with the regional trend, but with two exceptions in each category. Average earnings are also slightly above average in the region, but this tendency has three exceptions among the service classes. Significantly, manufacturing cities, of which there are 88 in this area, are below the national average in earnings for this class of city.

SOUTH

In the South, as in the West, the region's characteristics are strongly reflected in all classes of cities within the area, though, as before, variations attributable to service class are still present. For six of the seven categories investigated, however, the South's characteristics, above or below the national average, are carried over in the cities of each service group, almost without exception.

The South's urban growth in the 1940–50 decade was well above the national average, and this population increase was reflected in cities of every class. There were the usual variations, from a low of 14.8 per cent in manufacturing cities, to an apparent high of a 94.6 per cent average increase in the professional service cities.

The average number of school years completed varies within the South by a full four years, from 8.2 years in the area's wholesaling cities (a national record low) to 12.2 years in the professional service cities of the South. Even so, the South is characterized by a lower than average number of school years completed; and no service class, in spite of the large variations illustrated above, has a regional figure higher than the national average for its class.

TABLE V

PER CENT NON WHITE IN ALL CITIES, ALL MFG. CITIES, AND ALL SD3 AND SD2 CITIES

	All cities	*All mfg. cities*	*R3 & R2 cities*	*Pf3 & Pf2 cities*	*T3 & T2 cities*	*Ps3 & Ps2 cities*	*Pb3 & Pb2 cities*	*W3 & W2 cities*	*F3 & F2 cities*
West	2.8	1.5	5.1	0.6	3.2	4.1	2.8	3.7	3.1
North Central	3.4	3.4	1.8	4.5	2.6	1.5	9.7	1.6	2.4
Northeast	3.0	1.8	3.0	5.2	0.9	17.0	6.2	0.1	5.0
South	21.5	15.5	17.3	16.0	17.6	21.2	21.6	21.3	18.7

Source: Compiled from Table 35, Vol. 2, Census of Population, 1950.

Average earnings in the South are generally low, and for all of the eight classes of cities investigated average income in the South is lower than for the national average of the class. Professional service cities nationally have the lowest average income, and, as one would expect, the $1318 average of the eight professional service cities in the South is the lowest average for any regional group in the country.

The South generally has a larger proportion of women in the labor force than the United States average, and all of the classes of cities in the area also have a figure the same as or greater than the national average. The South's 41.5 per cent of women employed in manufacturing cities is high for the country.

The generally small proportion of people in the cities of the South that are 65 or over is apparent in that, for all classes of cities except retail trade, the South has the same as or a smaller percentage than the national average. Similarly, the proportion unemployed in the South is low, and for all classes of cities except transportation cities the figures are below the national averages.

NEGROES

Because of the historic concentration of the American Negro in the South, consideration of this important ethnic feature of our cities was reserved for discussion here. However, the proportion of Negroes (the census term is non-whites, but for our purposes it can be considered as Negroes) were tabulated for the 897 cities previously used, and divided according to the average for census regions and service class of city. The results appear as Table V.

The South is habitually recognized as the traditional home of the Negro, and in spite of recent migrations the South's average proportion of Negroes, 21.5 per cent, is far larger than the average proportion of cities in other regions. (There are only seven urban communities of over 10,000 persons in the nation with over 50 per cent of their population Negro, and they are all in the South.) In every service class, the Southern city has retained leadership. However, variations occur from Southern cities of one class to another. Personal service, public administration, and wholesale cities lead in the proportion of Negroes with about one-fifth of their population Negro, while the other classes average slightly less, from 15 to 18 per cent. It is worthy of special notice that manufacturing cities in the South, on the average, have the fewest Negroes.

Outside of the South, Negroes in larger than the usual proportions of their respective regions are found in several classes of cities. The three personal service cities of the Northeast have an average of 17 per cent Negroes, a figure comparable to many classes of cities in the South. (These three cities

are Atlantic City, New Jersey (Ps3R); Asbury Park, New Jersey (Ps3RPb); and Saratoga Springs, New York (Ps2). Then, too, public service cities in both the Northeast and North Central regions have two or three times the regional average of Negroes. Finally, perhaps contrary to general opinion, in no section of the country do manufacturing cities have anywhere near the largest proportions of Negroes, compared to other classes of cities, in their respective regions.

SUMMARY

The foregoing discussion indicates the influence of both service class and regional location on the characteristics of a city, at least as far as the categories we have discussed are concerned. Generally, the characteristics of a region tend to be impressed on all classes of cities within an area, without, however, obliterating the large variations attributable to the service class. This is particularly true in six of the categories: percentage change in the population, per cent 65 years old or older, years of school completed, average income, percentage unemployed, and proportion of Negro population. Participation in the labor force, by both males and females, on the other hand, seems the least strongly affected by regional location.

THE AGRICULTURAL REGIONS OF TASMANIA: A STATISTICAL DEFINITION

Peter Scott

Mr. Scott, formerly Head of the Department of Geography at the University of Tasmania, is now on the staff of the Research School of Pacific Studies, The Australian National University, Canberra.

THE recent survey of American geography at the mid-century focused the attention of the agricultural geographer on the lack of valid procedures for relating, firstly, topical analysis to regional synthesis and, secondly, the more intensive study of small areas to the more highly generalized treatment of large areas.[1] In the same year as this survey was published there appeared three important papers on cropland use in the Middle West, in which Weaver advanced inter alia a valuable statistical procedure for defining crop-combination regions.[2] In this article Weaver's procedure is first applied to Tasmania—a compact, mid-latitude laboratory with considerable diversity of cropland use—and then modified and extended to embrace a definition of agricultural regions in terms of both arable and pastoral farming. Such a definition may perhaps serve not only as a basis for relating the topical to the regional study but also to suggest the elaboration of a regional hierarchy in which the intensive study of a small area may be related to a larger pattern.

The data used in this study have been official unpublished Tasmanian statistics for 1954. Prior to 1952 the smallest unit for recording agricultural and pastoral statistics in Tasmania was the municipality, but in that year a record was kept of the totals returned by each police station undertaking the collection, though these were not published and the boundaries of the "police districts" were not recorded. In 1954, however, the Tasmanian Branch of the Commonwealth Bureau of Census and Statistics very kindly undertook at the writer's request not only to make available statistics by police districts but also to determine district boundaries (Fig. 1). This has permitted the use of 120 districts instead of the former 49 municipalities. It was later decided to exclude the Bass Strait islands owing to the need for a compact laboratory, to exclude several west-coast mining districts essentially non-agricultural in character, and to consolidate several small peri-urban districts. Since the west is too rugged and too wet for agriculture, the resultant 105 unit areas form an arcuate belt through the north and east of the island.

Only the major steps in Weaver's

[1] Preston E. James and Clarence F. Jones (Editors): *American Geography: Inventory and Prospect*," New York, 1954, pp. 258–277. Published for the Association of American Geographers by Syracuse University Press.

[2] John C. Weaver: "Changing Patterns of Cropland Use in the Middle West," *Econ. Geog.*, Vol. 30, 1954, pp. 1–47; *idem:* "Crop-Combination Regions in the Middle West," *Geogr. Rev.*, Vol. 44, 1954, pp. 175–200; and *idem:* "Crop-Combination Regions for 1919 and 1929 in the Middle West," *Geogr. Rev.*, Vol. 44, 1954, pp. 560–572. (A further article in the series, "Livestock Units and Combination Regions in the Middle West," by John C. Weaver, Leverett P. Hoag, and Barbara L. Fenton, *Econ. Geog.*, Vol. 32, 1956, pp. 237–259, appeared after Mr. Scott's article was received.—Editor.)

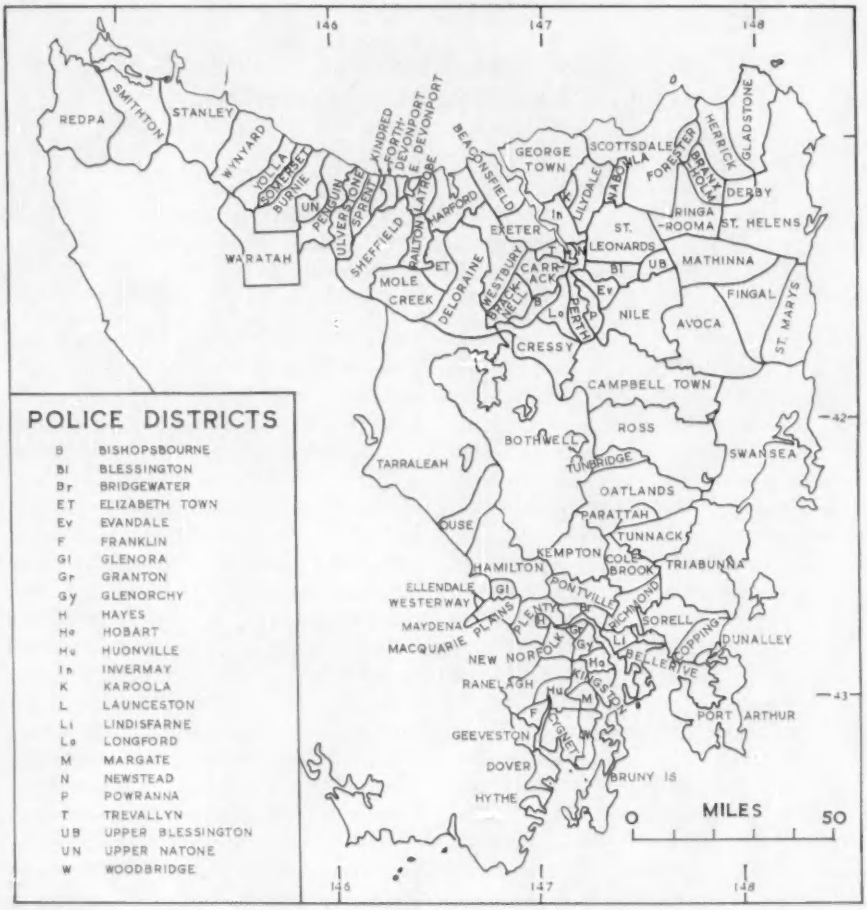


FIG. 1.

statistical procedure need be stated here. It involves, firstly, the calculation for each police district of the percentages of total cropland occupied by individual crops; secondly, the arrangement of these percentages for each unit in order of size; and, thirdly, the measurement of each declining curve of ranked percentages against a theoretical curve to determine the lowest deviation and therefore the basic crop combination. The procedure is defined in detail in the first of Weaver's papers on crop-combination regions; repetition here will be confined to those aspects from which the present study departs.

THE RANKING CROPS

It will be useful to begin by following Weaver's "admittedly rudimentary but nevertheless enlightening first step" with an examination of the patterns presented by the crops ranking first, second, and third. Although it is not the primary aim to present a detailed geographical interpretation of Tasma-

nian agriculture,[3] a brief discussion of certain basic features suggested by the ranking crop maps will at least permit a greater understanding, and therefore a more critical assessment, of the ensuing composite patterns. In the accompanying maps, as well as in the discussion of crop combinations, letter symbols are used, following Weaver, to designate the principal crops. These are defined as follows:

- H hay, including both native grasses and introduced grasses and clovers
- O oats, harvested for all purposes—for green fodder, hay, and grain
- W wheat, harvested for all purposes—mostly for grain but also for hay and green fodder
- B barley, both English and Cape, grown almost wholly for grain
- P potatoes, including those harvested for seed
- Pe field peas, mostly Maple or Grey peas but including the Prussian Blue
- T turnips, mostly white but including some swede
- G green fodder crops, other than grasses, clovers, and grains. Mostly chou moulier, kale, and rape
- Tf tree fruits, mostly apples, pears, and apricots
- Sf soft fruits, mostly raspberries and black currants but including loganberries, gooseberries, strawberries, and blackberries
- Hp hops
- V vegetables, excluding potatoes and turnips, harvested for sale
- N nursery products

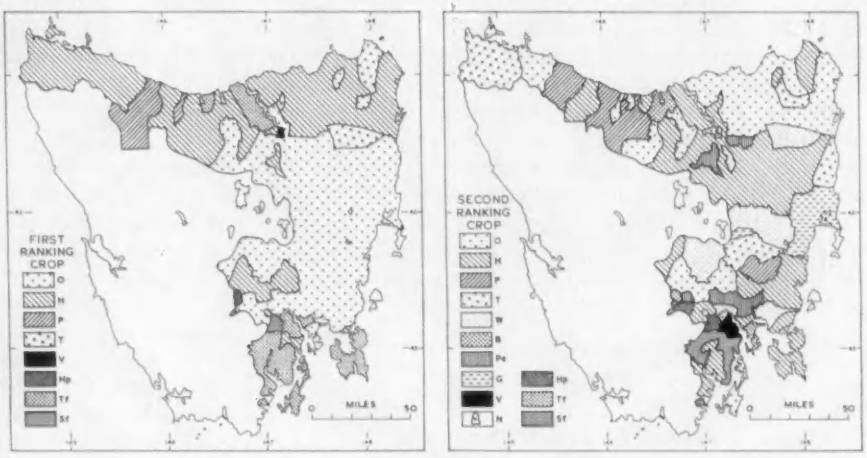
The first rank map suggests a basic division into three regions, which broadly corresponds to that advanced by Taylor[4] (Fig. 2). Although eight different crops hold first place in one or more police districts, one or another of three crops—hay, oats, or tree fruits—ranks first in all but 13 districts. Hay is dominant along the northern coastlands where humid mesothermal conditions (BB′r)[5] permit good pasture growth throughout the year; oats in the subhumid microthermal Midland and east-coast districts (CC′r), where pasture growth is slow in winter; and tree fruits in the warm moist valleys of the southeast. Other notable features are the predominance of potatoes at the center of the basalt country in the northwest (potato growing is markedly localized by the occurrence of red basaltic loams), orchards around Devonport and along the West Tamar (but not along the East Tamar where dairying and the fattening of sheep and lambs are increasingly more important than fruit growing), vegetables in the peri-urban areas of Launceston (but not of Hobart), and small fruits in the hills south of New Norfolk. It should be noted perhaps that the Ellendale-Westerway area where hops rank first is not the principal hop-growing district in Tasmania.

Although the second ranking crop map presents a somewhat fragmented pattern, it is at once apparent that

[3] For a generalized land-use map of Tasmania in color see A. G. Lowndes and W. H. Maze: *Land Utilization Regions of Tasmania*, Univ. of Sydney Pubs. in Geography, No. 4, Sydney, 1937. Although this map is valuable as giving a composite picture of land use in the mid-thirties, it is based on a reconnaissance survey and there are several important omissions and inaccuracies. These, however, may be discovered by comparison with the many detailed maps in State Economic Planning Authority: *Regional Planning Atlas: Economic Resources of Tasmania*, Hobart, 1947.

[4] Griffith Taylor: "Agricultural Regions of Australia," *Econ. Geog.*, Vol. 6, 1930, pp. 109–134 and 213–242; reference on p. 127.

[5] For the climatic regions of Tasmania according to the 1931 Thornthwaite classification see State Economic Planning Authority: *Regional Planning Atlas, Economic Resources of Tasmania*, Hobart, 1947 Map No. 25.

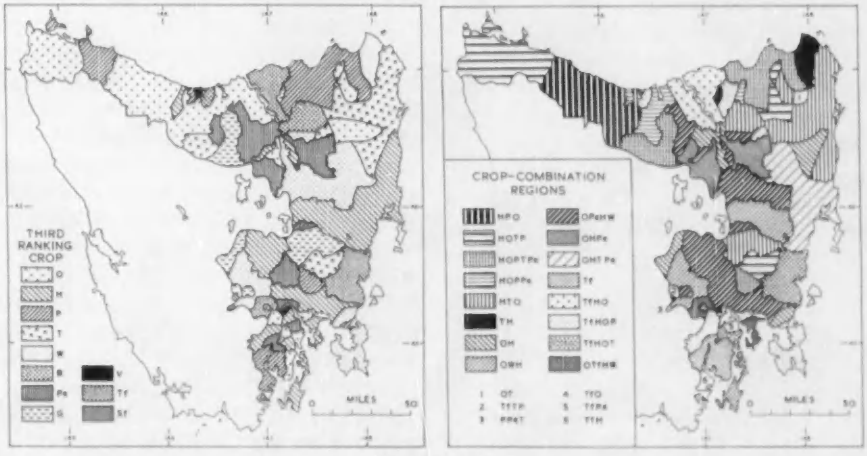


FIGS. 2 and 3.

the two dominant first ranking crops have been interchanged over much of the northern and east-central regions and that hay is the dominant crop in the southeast (Fig. 3). In the potato-growing region of the northwest, hay ranks second to potatoes at the center, while potatoes rank second to hay elsewhere. In the remaining areas of the north, but especially in the northeast, oats is the principal number two crop; it is ousted, however, by turnips in the high-rainfall dairying country of the far northwest and again in the Branxholm district of the Ringarooma valley in the northeast, as well as by barley in the Sassafras area (Harford police district). At Sassafras, malting barley occupies an established place in traditional crop rotations, even though the spring rains are less reliable than farther east and occasional low-yielding crops have to be fed to stock. Sassafras, incidentally, is probably the only farming district of Tasmania where crop rotations have long been rigorously followed; elsewhere general rotational cropping rather than specific crop rotations is the rule, and even rotational cropping dates only from the early thirties. In the north Midlands hay ranks second to oats, except on the Longford plains where probably the most favorable conditions in Tasmania are found for the cultivation of field peas and wheat. The Irish community of the Tunnack hill country specializes in the production of seed potatoes, since the comparatively high altitudes (above 800 feet) give both a higher rainfall and immunity from potato disease. Beyond this, the farming pattern of the Longford district reappears, though the land here is far more broken and the climate drier. At Macquarie Plains hops confined to the terraces of the Derwent Valley rank second to oats, though here the concentration of hop-fields is the largest in Australia; the map also reveals the recent sinuous extension of hop growing along narrow strips of alluvium in tributary valleys south of New Norfolk. Finally, the peri-urban areas of Hobart have vegetables ranking second to tree fruits, whereas the hill country to the southwest have small fruits second to tree fruits.

A surprising feature of the pattern portrayed by the third ranking crop in acreage strength is that fragmentation

is less than might be expected and certainly less than in Weaver's maps of the Middle West (Fig. 4). Thus for Tasmania there are eight first ranking crops, 13 second ranking crops, and only 11 third ranking crops, whereas in Weaver's maps for both 1939 and 1949 third ranking crops are more numerous than those ranking first or second. The most striking feature of Figure 4 is the broad expanse of oats in the northwest, which in general dovetails with the equally broad expanse of oats in the northeast in Figure 3. In fact, the west-to-east sequence of crops in the pattern for the second rank map is broadly reproduced in the east-to-west pattern for the third rank map. This is borne out by the occurrence of turnips in third position for the far northeast, of potatoes at Branxholm, Scottsdale, and Lilydale, of barley at Evandale, and of peas and wheat in the north Midlands. In the northeast, potatoes are grown only on limited tracts of red loam and mainly for the Launceston and Hobart markets, while climatic and soil conditions at Evandale probably approach most nearly in Tasmania the optimum for malting barley. In the Midlands the reversal of the crop pattern between Figures 3 and 4 is from the northern and southern margins to the center; this emphasizes the fact that it is the hardier crops that occupy third position in the northern and southern localities where conditions favor cropping, and the less hardy crops that rank third in the higher, drier, colder and more exposed districts of the center. A notable irregularity in the pattern is occasioned by orcharding, which also breaks the otherwise repetitive sequence in the north; yet the East Tamar, Triabunna, and the Derwent Valley are all minor orcharding districts, where warmer and drier conditions than in the main apple-growing district of the Huon Valley give an advantage to irrigated canning-pear production and where orcharding in general and apple growing in particular are declining in importance both relatively and absolutely. Southeastern Tasmania, having revealed in Figures 2 and 3 its distinctive specializations of tree fruits, small fruits, and hops, relapses in Figure 4 into a confused yet meaningful pattern which reflects the salient features of



FIGS. 4 and 5.

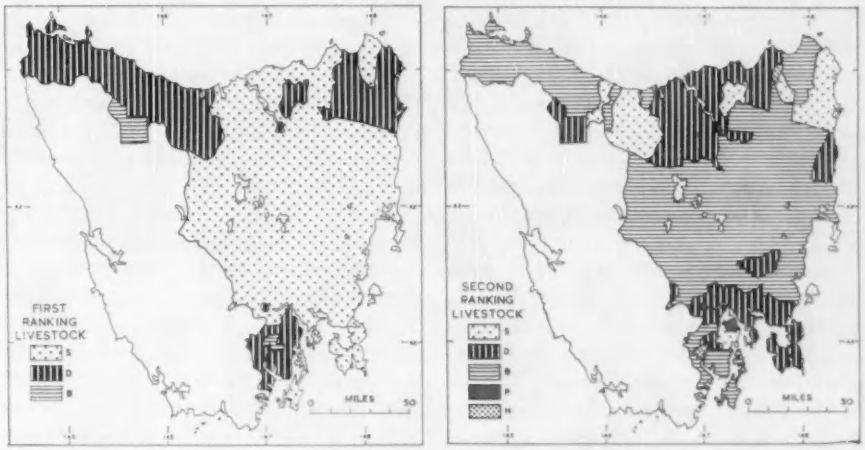
arable farming both in the Midlands and the north.

CROP-COMBINATION REGIONS

The procedure followed in establishing crop-combination regions for Tasmania differs from that advanced by Weaver only in the definition of standard crops to figure in the crop combinations and, relatedly, in the treatment of specialty crops. These departures have been made in an attempt to make the procedure even more "objective, constant, and precisely repeatable." Thus the "bases of primary regional differentiation" have been determined by applying the statistical procedure for defining crop combinations to the ranked arrangement of percentages of total cropland occupied by each crop over the entire area under examination. For Tasmania this gives seven basic crops, including three—potatoes, field peas, and tree fruits—classified by Weaver as specialties. It would in fact have been misleading not only to have restricted the basic pattern to what are essentially "field crop combination regions" but also to have merely superimposed symbols representing specialty crops occupying more than 3 per cent of total cropland, since this latter procedure fails even to signify whether the specialty crops figure in the statistically determined combinations, much less their true relative importance.

In Figure 5, following Weaver, such groups as POH, HPO, PHO, or any other variant of rank have been consolidated into common crop combinations. But Tasmania is so small and yet so diverse a laboratory that some combinations have remained unique and these have merely been listed below the main key. It is in fact symptomatic that five of the six unique combinations are located in the complex region of the southeast. Consolidation proved to be most effective in the potato-growing region of the northwest, where ten districts have a combination derived from hay-potatoes-oats; westward this combination takes in turnips as well, eastward field peas, and southeastward both field peas and turnips. This latter combination of HOPTPe reappears in the northeast. In the drier north Midlands, both potatoes and turnips disappear, leaving oats-hay-field peas the characteristic combination. Farther south, and again in the south Midlands, wheat joins the OHPe group; elsewhere in the Midlands and the Derwent Valley, field peas disappear, leaving simply oats-wheat-hay. Tunnack and Scottsdale are similar in having a hay-oats-turnips-potatoes combination, which in both cases merges into a hay-oats-turnips pattern. The apple-growing districts bordering the D'Entrecasteaux Channel and in the Huon Valley present the only monoculture; all the other main orcharding areas embrace at least oats and hay as well and most have either potatoes or turnips or wheat as a fourth element.

Yet Figure 5 presents only a partial picture, for it excludes certain crops of limited over-all acreage which assume prominence in local agricultural landscapes. Among the eight first ranking crops, for example, are soft fruits, hops, and vegetables, which together occupy extensive areas on the second rank map; yet these have been excluded from the crop-combination regions. Another locally important crop excluded from the basic combinations is barley. But if this map had been reproduced in color instead of in black and white, it would have been possible to include the non-basic crops ranking in the statistically determined combinations for individual districts, as Weaver includes specialty crops, as superimposed symbols. Even so, the map would still not



FIGS. 6 and 7.

stress the role of these crops in local farming systems.

Finally, although Figure 5 may have great value to the local specialist making a detailed study of crop associations and changing cropland use in Tasmania, it is for our present purposes bewildering: the map neither defines major regions nor permits the definition of a hierarchy of subregions. Yet the definition of a regional hierarchy might have followed if the ranked letter combinations had been retained. The first rank map would then have suggested the major divisions, while the other crops in the basic combinations would have given scope for subdivision. The retention of the ranked letter combinations, however, would have yielded a pattern far too complex and far too fragmented for portrayal cartographically by any black-and-white shading system; the number of basic combinations would have been 51 compared with the 22 in Figure 5. This heterogeneity stems partly from the fact that land use in Tasmania is primarily pastoral. It is therefore proposed to extend the statistical procedure advanced by Weaver to an analysis and synthesis of livestock distributions.

THE RANKING LIVESTOCK

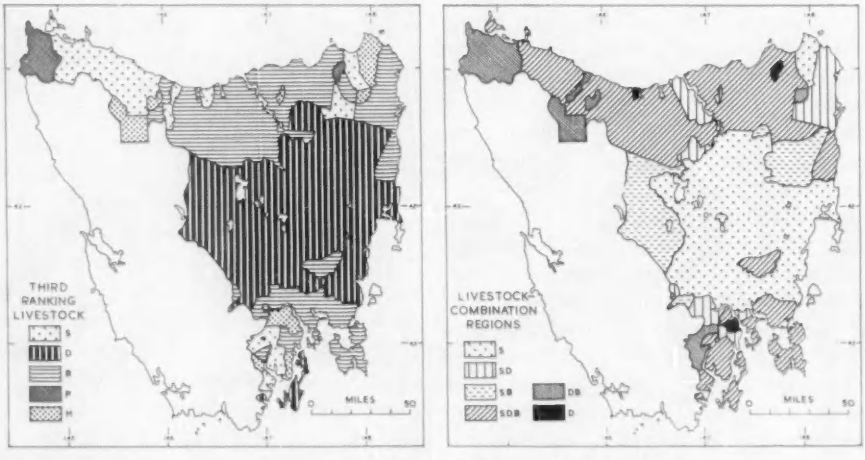
The application of Weaver's rudimentary first step to livestock distributions involves ranking for each police district the percentages of total livestock represented by the major categories. For this purpose livestock units were defined, following the United States Department of Agriculture, as one horse or head of cattle equalling seven sheep or five pigs. The livestock categories used were dairy cattle (D), beef cattle (B), sheep (S), horses (H), and pigs (P).

The first rank map, as with the ranking crop maps, presents a pattern distinct from any portrayed by dots or choropleths (Fig. 6). Sheep rank first throughout the drier areas of eastern Tasmania: from Port Arthur and the Derwent Valley in the south to the Tamar estuary in the north, and from the Central Plateau (a negative area for arable farming) in the west to the east coast. Dairy cattle predominate in the higher-rainfall areas northwest of Deloraine, around Lilydale, and in the Ringarooma Valley; in the higher-rainfall areas adjacent to a large urban market, as in the Huon Valley and along the Channel

coast; and even to a limited extent in the drier peri-urban areas of Launceston. Aside from the Huonville district, where comparative prosperity has permitted many former dairy farmers to change to a less exacting type of animal husbandry, beef cattle rank first only in more remote, more rugged, high-rainfall country.

The second rank map is even more illuminating (Fig. 7). Sheep, which assumed such prominence in the drier areas on the first rank map, take second place only in a few adjoining, higher-rainfall, fattening areas; from Penguin to Deloraine in the northwest, around Lilydale, Ringarooma, and St. Helens in the northeast, and Hobart in the south. By contrast, beef cattle are the dominant second livestock over most of Tasmania: throughout the central Midlands with an extension northeastward, along the northwest coast from Burnie to Redpa, and in the Huon Valley. The broad extent in the Midlands, however, is broken by the Tunnack hill country, where in association with the HOTP crop combination dairying comes into its own. Dairying also ranks second in the more intensive mixed farming areas of the lower Midlands both in the north and the south and extends into adjoining districts. Warratah is used mainly for the seasonal grazing of dairy cattle from the coast, whereas at St. Marys on the east coast dairying is declining in favor of beef cattle. Pigs appear as the second livestock in the peri-urban dairying areas of Hobart, Launceston, and New Norfolk (largest town after Hobart in the Derwent Valley and the sixth largest in the State), and horses retain a secondary importance in the intensively-developed orchard hill country at Franklin in the Huon.

The third rank map is essentially the counterpart of the second, for in general beef and dairy cattle are interchanged (Fig. 8). This holds true not only for the extensive Midlands, including the Tunnack district and the lower north and south, but also for the Tamar, the Derwent Valley, and the southeastern segment from the Derwent estuary to Port Arthur. The only notable exceptions are sheep as the third livestock in the far northwest from Burnie to Smithton, in much of the Huon, and around Ringarooma. Pigs also rank third at Marrawah and Redpa, the most



FIGS. 8 and 9.

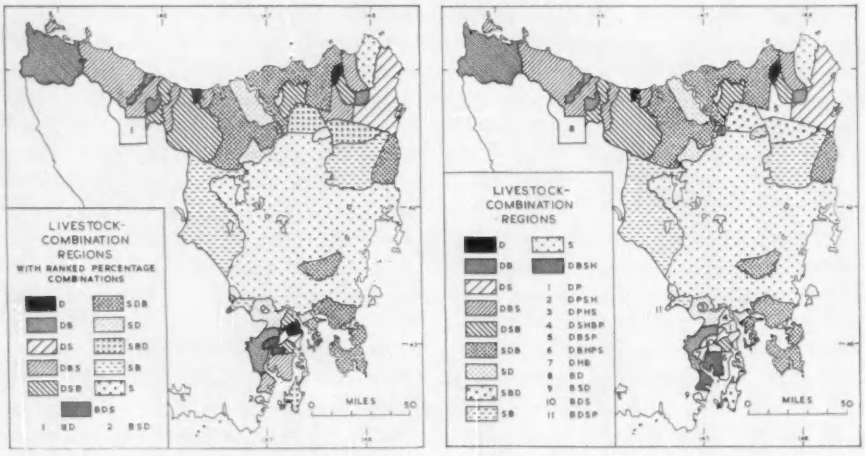
intensively-developed dairying district in the State, while horses assume prominence in many hill localities.

Lastly, it is worthy of mention that horses rank fourth throughout most of Tasmania and pigs fifth.

LIVESTOCK-COMBINATION REGIONS

The application of Weaver's statistical procedure to the ranked arrangement of percentages of total livestock represented by each category for Tasmania as a whole resulted in three basic categories of livestock—dairy cattle, beef cattle, and sheep. In Figure 9, such groups as SDB, DSB, DBS, or any other variant of rank have been consolidated to yield only six common livestock combinations. The map reveals a broad division of Tasmania into three major livestock regions, which significantly correspond in outline to the threefold division presented by the first ranking crop map. Although in general the northern coastlands are characterized by three-livestock combinations, sheep are notably omitted from the combinations at the center of the potato-growing district, in the high country of Warratah, and in the high-rainfall, dairying districts of Smithton and Redpa. In east-central Tasmania the expanse of sheep farming merges on the wetter, more exposed, western areas of the Central Plateau—but significantly not on the drier, more sheltered eastern segment—into a sheep and beef cattle combination, which reappears at Avoca and Fingal on the lower eastern plateau. Tunnack stands out with its distinctive three-livestock combination. In the southeast the three-livestock combination of the north is again dominant, but the middle Derwent Valley appears to represent in its sheep and dairy cattle combination a transitional zone between the Midlands and the Hobart region, whereas the higher-rainfall districts of the west Huon reflect the dairy and beef cattle combination of the far northwest.

Since the number of ungrouped livestock combinations derived from the three basic categories totals only 13, it is possible to portray in black and white the pattern presented by the ranked percentage combinations. In Figure 10, the two numbered combinations apply each to a single district, both agriculturally marginal and of minor importance. Elsewhere the most striking feature is not the definition of discontinuities, which broadly correspond with those of Figure 9, but the evidence which the map provides of a gradual change in the relative importance of individual types of livestock in response to a changing environment. This is most marked in northern Tasmania. Thus the DB combination of the far northwest merges gradually eastward, with decreasing rainfall, into an area where sheep assume third place (DBS). Farther east, sheep become more important than beef cattle, so that, with dairying still dominant, the group becomes DSB. Beyond Deloraine, with a still lower rainfall, sheep finally become dominant, furnishing a combination of SDB. In the superhumid pockets of the northeast, dairying regains pride of place, but in the humid hill country south of these areas, the sequence continues eastward: first, beef cattle oust dairy cattle from second place, so that the combination is now SBD; then southeastward, with the onset of subhumid conditions on the eastern plateau, dairying disappears, the group now being SB. Finally, in the subhumid Midlands, beef cattle, which had been dominant nowhere in the sequence, also drop out, leaving sheep at last supreme. In the southeast, a secondary sequence is discernible in the Huon, Channel, and Derwent districts, but here continuity is broken by irregular relief and urban influences.



FIGS. 10 and 11.

If reproduction of Figures 9 and 10 had been in color, it would have been possible to include the non-basic livestock ranking in the statistically determined combinations as superimposed symbols. Yet since the number of livestock types is so few, compared with the variety of individual crops, it is possible to reproduce in black and white the pattern expressed by the statistically determined combinations without restricting the groups to the three basic categories. In Figure 11 further evidence of the agricultural complexity of the southeast is provided by the concentration in this region of no less than eight of the 11 unique combinations. Even the one group not included in the two previous maps but applicable to two or more districts relates only to the Huon. In fact, the distinctive value of Figure 11 is that it establishes the important association of pig farming with dairying around Launceston, Scottsdale, and in the Derwent Valley, as well as the continued use of horses in the areas of specialized agriculture in the Derwent and Huon Valleys.

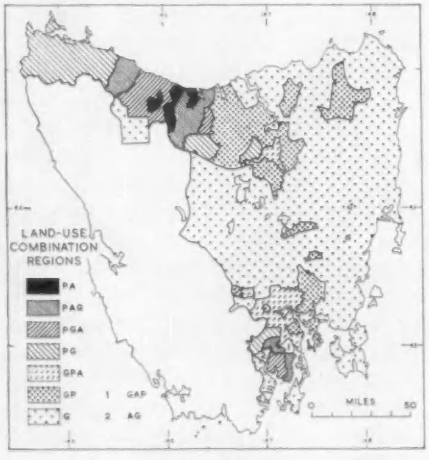


FIG. 12.

LAND-USE COMBINATION REGIONS

The next step is to relate the crop and livestock combinations by applying Weaver's statistical procedure to relevant acreage categories. For this purpose three broad categories of the World Land Use Survey have been employed: cropland or arable (A), which, to correspond to the crop combinations, here embraces both horticulture and tree crops; improved pasture (P); and unimproved grazing land (G).

In Figure 12 the ranked percentages of the resultant combinations have been retained to give seven main combinations, each applicable to two or more districts, and two unique combinations. The outstanding feature of the map is the dominance throughout eastern Tasmania of unimproved grazing land; even Tunnack is no longer distinguishable. In fact, improved land, aside from the two outliers in the northeast and the two in the Midlands, is confined to the northern coastlands northwest of Cressy and Evandale and to the Huon and Derwent Valleys. Ulverstone stands out as the most intensively developed district in the State, and the orcharding center of Geeveston as the only district with cropland pre-eminent.

AGRICULTURAL REGIONS

It remains to apply this land-use index to crop and livestock combinations in order to arrive at comprehensive multiple combinations. But since the primary aim is not to evolve a bewildering multiplicity of complex associations of the crop, livestock, and land-use combinations but to define major agricultural regions, the basic elements only need be selected from each set of combinations. Thus the fundamental feature of the map depicting land-use combinations is the distinction between those regions having combinations of arable and grassland and those regions having combinations of grassland only. Similarly, the livestock-combination regions with ranked percentages need provide only the first ranking categories. At first, the crop combinations pose a more difficult problem, but examination of the arable-grassland areas as defined by the land-use combinations reveals three basic features of commercial cropping: in the northwest, all crop combinations have potatoes as the cash crop; in the southeast, tree fruits; and elsewhere, field crops such as cereal grains. Accordingly, to define the major agricultural regions, the boundaries of the consolidated arable-grassland groups have been superimposed on those of the first ranking livestock regions, and for the arable areas the basic cash-crop features have been incorporated. Subsequently, it was deemed necessary for adequate description to subdivide the fattening areas with sheep-dairy cattle combinations on the basis of the percentage of ewes mated to British rams: areas with percentages exceeding 50 were classified as specializing in fat lambs and those with less than 50 as producing mainly fat sheep. In these cases it was also decided to incorporate in the descriptive key a reference to dairying, since dairying and fattening are concomitant functions. The key cites the major livestock combinations, since these suggest not only the nature of regional composition but also the means of possible subdivision. Crop combinations would further permit the elaboration of a regional hierarchy, but Tasmania is clearly too small a laboratory for this. Even such an extensive first-order region as the Midlands would have almost as many third-order regions as there are police districts.

Perhaps the most pregnant and certainly the most pleasing feature of Figure 13 is that the pattern of agricultural regions in Tasmania exhibits an essential symmetry, strikingly so in the north between east and west about a Tamar axis and less strikingly so between north and south about an east-west axis through the central Midlands. In the north, sheep and dairying occur on both banks of the Tamar, with fat lamb raising and dairying farther afield; moreover, dairying emerges predominant west of Wynyard and in the Mole Creek and Elizabeth Town districts

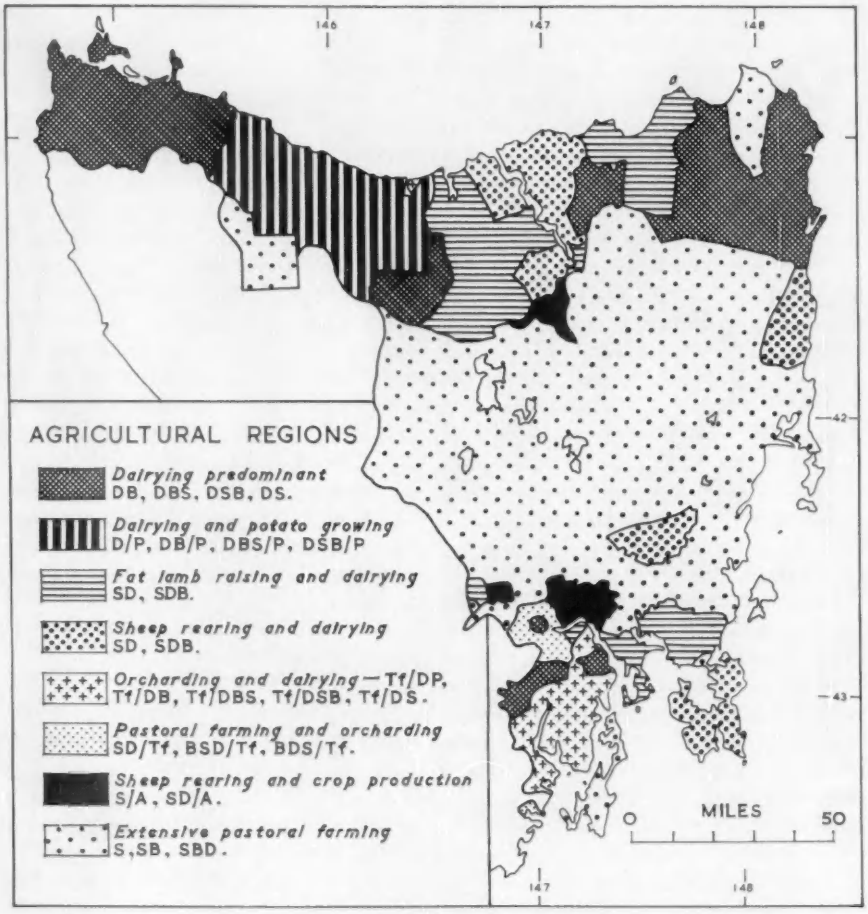


FIG. 13.

on the one hand, and around Lilydale, in the Ringarooma Valley and adjacent districts on the other; finally, extensive pastoralism characterizes both Waratah and Gladstone. This sequence, however, is broken in the northwest by dairying and potato growing, which, like orcharding and dairying in the southeast, is a unique regional specialization. In east-central Tasmania, the symmetry is maintained in the repetition at Longford and Pontville of mixed farming based on sheep and the cultivation of grain and pulse crops, and at Tunnack and St. Marys of sheep and dairying. In fact, all types of agricultural region found in the north, if dairying and potato growing may be typified simply as a unique regional specialization, have their counterparts in the south.

Finally, it should be added that, although the boundaries to these agricultural regions require substantial revision in the light of actual distributions, the validity of the general regional definition

has been confirmed by an independent field survey undertaken by the writer.

CONCLUSIONS

In this paper the valuable statistical procedure advanced by Weaver for the study of the dynamic forces which induce change in the patterns of cropland use has been extended to embrace a tentative definition of the agricultural regions of Tasmania. The method followed in establishing crop-combination regions differs from that put forward by Weaver in two related aspects: firstly, in the application of the statistical procedure to the definition of basic crops and, secondly, in the inclusion of both field and specialty crops in this definition. It would seem, however, that in any such application of the statistical procedure to a definition of agricultural regions the ranked percentage series in the basic crop combinations should also be retained, however fragmented the resultant pattern. For a study of the crop and livestock patterns in Tasmania reveals that both the grouped combinations and the ranked combinations are relevant, since it is the ranked combinations rather than the grouped combinations which define the major crop regions and the grouped rather than the ranked combinations which define the livestock regions. This stems from the fact that crop associations are by no means so strong in Tasmania as livestock associations. Lastly, it is suggested that the application of Weaver's statistical procedure to a definition of agricultural regions opens up the possibility of elaborating regional hierarchies, though the more elaborate the hierarchy the larger loom three important subjective elements: the unit boundaries, the statistics themselves, and the selected definition of the crop, livestock, and land-use categories employed. In human geography the human element can never be gainsaid.

OBSERVATIONS ON LAND USE IN IRAQ

D. Hywel Davies

Mr. Davies, formerly of the College of Arts and Sciences, Baghdad, is now on the staff of the University of Cape Town.

THE modern kingdom of Iraq presents an interesting study in land use, a field which has only recently attracted serious attention. Archaeology, oil, and political affairs have been the main foci of foreign interest in the country, but with the present activities of the Iraq Development Board which, with the aid of the swarms of foreign experts now settled on Baghdad, is engaged upon the task of plowing back the profits from oil into the development of the nation's agriculture, land use has become a vital study in applied geography.

The significance of ancient Mesopotamia as a major granary of the world is well known.[1] Today, however, agriculture in this region is underdeveloped despite the fact that it is, and must remain, the dominant occupation among Iraq's five million people. But as the drainage, irrigation, and associated schemes now projected or already in progress reach completion, the age-old graph of agricultural production must begin a new upward swing. It thus seems important at this particular stage to attempt an assessment of the present position in land use, for the patterns will change rapidly, and on the true appraisal of the present facts must depend the value of schemes for future development.

In 1954 the author completed for the World Land Use Survey a Provisional Land Use Map of Iraq on a scale of one to a million.[2] This paper attempts an explanation of the major patterns revealed on that map, rather than a description of what each indicated category implies in terms of crops or pastures, which is mainly confined to the fairly detailed key to Figure 1. The inevitably fractionated appearance of a land use map, even on this scale, does not permit of reproduction on these pages, but Figure 1 is a much simplified reduction of it; adequate to indicate the major patterns discussed below. Figure 5 shows the Iraqi Kurdistan section of the original map on a less reduced scale, and serves to indicate its much greater complexity.

Cropland, together with areas of tree crops and agriculture, must be considered as central cores of positive land use in Iraq, around which are disposed the comparatively negative areas of unimproved grazing land and other categories. Therefore, most attention has been devoted to some explanation of the disposition of cropland, for this seems, to the author, the key to the whole map. There is close correlation, of course, between these positive areas and the distribution of rural population.[3] Map one indicates two types of crop-

[1] See *The History of Herodotus*, transl. by G. Rawlinson, Book 1, Chapters 192–193, Dent (Everyman), London, 1910.

[2] Based upon varied map sources, air photographs, and personal observation. The map was drawn on the base map of the Iraq sheets, of the G.S.G.S. 1:1,000,000 International Map, and published by the College of Arts and Science, Baghdad, 1954.

[3] See map in J. H. G. Lebon's "Population Distribution and the Agricultural Regions of Iraq," *Geogr. Rev.*, Vol. 43, 1953, pp. 223–228.

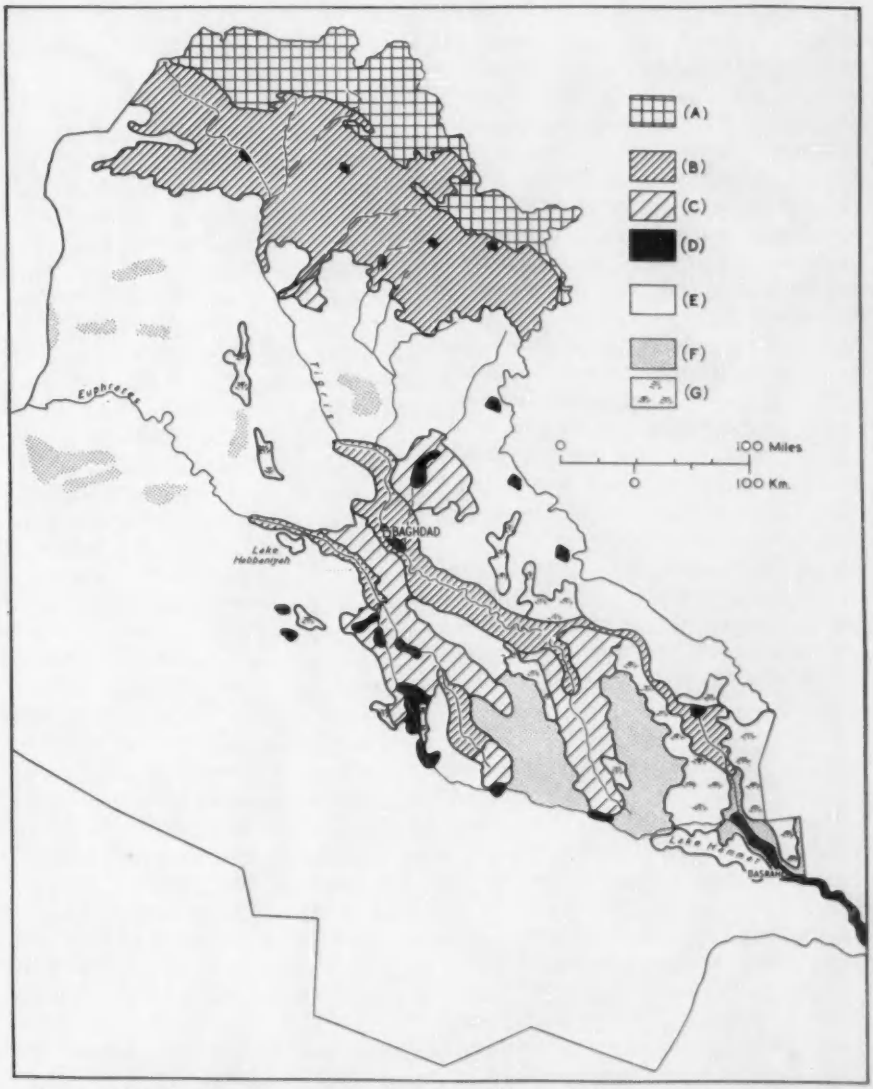


FIG. 1. Major land use categories. Letters refer as follows: (A) the mountain complex of Iraqi Kurdistan (see Fig. 5). (B) rotation cropland. Two-fold rotation of winter wheat and barley with fallow, dependent upon rainfall in the north and irrigation in central and southern Iraq, where 15 to 20 per cent of rotation cropland carries summer as well as winter crops. (C) land rotation. Areas of flow irrigation, where salting lowers fertility causing abandonment of some cropland. Otherwise similar to rotation cropland of the Irrigation Zone. (D) horticulture and tree crops. Intensive cultivation of summer and winter vegetables, mainly for sale in urban centers. Date palm groves in the south, mixed citrus and non-citrus orchards in central Iraq, and deciduous fruit orchards in the north. (E) unimproved seasonal grazing land. Available only in spring and early summer except in favored areas. Utilized for semi-nomadic and nomadic herding. (F) unproductive land. Sandy or stony desert and long-abandoned salt flats in the south. (G) marshes and impermanent lakes.

land—"rotation cropland" and "land rotation"—which may be said to represent respectively the use and misuse of suitable land by the farmers. Before introducing this human factor of misuse, however, the two types may be considered together in relation to the physical environment, which still asserts itself most strongly in this marginal landscape. For land to be cropped successfully in Iraq, two major sets of possibilities have to be realized. The first concerns the availability of soils and the terrain; the second, the availability of good water. One stresses "good" water, because there is a good deal of "bad" or saline water in Iraq. The interrelation of these two factors, both fairly straightforward in themselves, results in certain areas where cultivation is a possibility. Human factors then enter the story, for where these possibilities are realized occurs the cropland shown on the map. The two factors may be considered in turn.

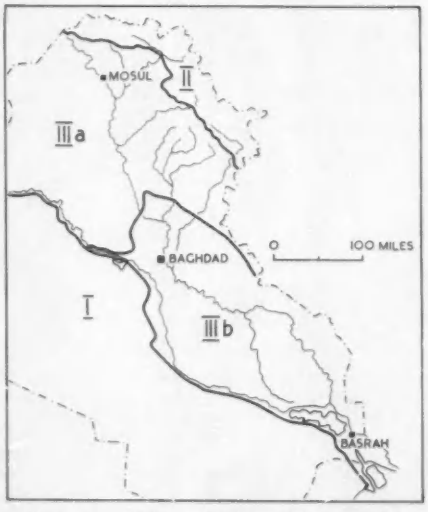


FIG. 2. Major physiographic provinces: I, Arabian Massif; II, High Fold Mountain Zone of Iraqi Kurdistan; IIIa, Miocene Plain of Upper Mesopotamia; IIIb, Flood Plain of Lower Mesopotamia. (Partly after Dubertret, and Boesch.)

POSSIBILITIES OF SOIL AND TERRAIN

Iraq lies across the three fundamental divisions of the physical landscape of the Middle East (Fig. 2). The Western, so-called "Desert" section, occupies a part of the stable Arabian Massif, where Archean basement rocks are overlain by almost undisturbed Mesozoic and Tertiary sedimentaries, dipping very gently east-northeast towards Mesopotamia. The eastern boundary of this region (I on Fig. 2) is well defined by a low line of cliffs overlooking the Euphrates as far north as Hit, and from there to the western frontier by the southwestern edge of the entrenched valley.

The covering sedimentaries are, in the main, thin, interbedded limestones and marls, with some remnants of sandstone beds which give rise to small patches of windblown sand; apart from these patches, the region is a monotonous, stony plain.

In detail, some variation of relief is provided by deep-cut wadis, aligned generally towards Mesopotamia. In such areas of dissection flash floods in winter cause much soil erosion. Away from wadis, however, there is some development of soil profiles, although the lack of a permanent vegetation cover implies little humus content. Even if these soils were adequate for permanent arable farming, the fact that they are necessarily best developed away from the wadis means that any irrigation from wells sunk into wadi floors would not be practicable. On considerations of terrain alone, therefore, this region is quite unsuited to any form of land use other than unimproved grazing, but, in any case, there is both inadequate rainfall and a lack of permanent watercourses. Small patches of wheat are cultivated during better years around wells on the wadi floors by semi-nomadic tribesmen, but the only

permanent farming is found in small patches scattered along the Euphrates valley itself as far as, and beyond, the Syrian frontier.

It is clear that the future of this region lies in the development of the existing grazing economy. From this viewpoint the region is no worse than semi-desert, for, after the winter rains, the surface, in spring and early summer, is green with pasture over wide areas, until all vegetation, save in a few spots in the deeper wadis, withers under the fierce heat and drought of midsummer, and the region reverts to desert until the next winter rains.

To the north and northeast the Iraqi frontier embraces part of the high fold mountain zone pushed up during Tertiary times and aligned around the edge of the Arabian Massif (II in Fig. 2). This is a region of simple folding, with parallel, anticlinal ridges and synclinal valleys and small, but important basins; the whole system increasing progressively in altitude towards the northeast where the ranges culminate in fine peaks over 10,000 feet above mean sea level.

In this region of Iraqi Kurdistan the terrain limits soil of a depth and quality adequate for cultivation to the valley and basin floors and to the lower hillslopes. Of these cultivable areas, the basin of Suleimaniyah is the largest and most important.

Between these two divisions the remainder of Iraq forms a central arc of lowland which is the eastern section of the "Fertile Crescent," occupying a geosyncline with apparently still-active sinking tendencies at its Persian Gulf end.[4] This trough appears to have been filled in by progressive deposition from north to south; past and present fluvial deposition and Quaternary glacial outwash and loess deposition all having contributed to this process. The deposits are thus generally older and at a higher level in the north, and as a result the arc may be divided into two geographical regions (IIIa and IIIb in Fig. 2).

Upper Mesopotamia (IIIa) is a rolling plain country built on Miocene deposits, but overlain by some Quaternary outwash material fringing the high mountain border to the northeast, and with some areas of loess. The region is bounded by the Euphrates valley to the southwest, the high fold mountains to the northeast, and a low cliff-line overlooking the lower alluvial floodplain to the south. The Tigris and its left bank tributaries, the Greater and Lesser Zabs, flow well below plain level in deep cut valleys, which narrow to rocky gorges where they break through upfolds such as the Jabal Hamrin. These northwest to southeast upfolds form a Piedmont zone in the east of this region, being aligned parallel with the main fold mountains beyond.

Over this rolling prairie land, gay with flowers in spring and a site of the first harvested wild wheat and barley, the sandy, gypsiferous soils, with areas of loess and old alluvium, are well suited to extensive rotation cropland; as is evidenced both by the present land use and by the numerous "tells" which dot this landscape of ancient Assyria. The only really unfavorable areas, from the point of view of terrain, are parts of the upfolds, where erosion has created a local "badlands" topography. This feature is well illustrated near the town of Chemchemal.

South of a line approximately through Samarrah on the Tigris and Hit on the Euphrates stretches the floodplain of Lower Mesopotamia, which falls little over 100 feet from these points to the Persian Gulf (IIIb). This great plain has been built up progressively since Quaternary times by alluvial deposition,

[4] See G. M. Lees and N. L. Falcon, *Geogr. Journ.*, Vol. 118, 1952, pp. 24–39.

not only by the Euphrates and Tigris, but also by the important left-bank tributaries of the latter, which have contributed large, alluvial fans whose surface is suited to the development of flow irrigation, particularly that of the Diyalah tributaries. Smaller fans form "oases" at Mandali and Badra along the Iranian frontier, and, finally, in the south, the delta of the Karun river from southwest Iran has cut off the lagoon and marsh area of southern Iraq, which the Tigris and Euphrates are progressively silting up.

Unlike upper Mesopotamia, the rivers here flow above plain level, building up natural levees, and meandering over the wide plain. Their frequent changes of course have helped to change history, and have developed in detail a microrelief pattern of tiny terrace remnants which is significant in establishing the pattern of land use. Over most of this floodplain, the rich, constantly renewed, alluvial soils are, in their natural state, excellent for the development of arable farming.

Over these four regions, it may be generally stated that the terrain precludes cultivation in the Arabian Massif region of southern and western Iraq; permits it in the valleys, basins and lower hill-slopes of Iraqi Kurdistan; and favors it over most of the central arc of the Fertile Crescent, which is the heart of Iraq.

AVAILABILITY OF GOOD WATER

Turning to the second factor—the availability of good water—it may be noted that water for cultivation in Iraq comes either dominantly from precipitation, with river water for summer crops as a supplementary factor; or almost entirely by irrigation from the rivers—the two areas being separate on the ground. It is common to state simply that northern Iraq has adequate rainfall for cultivation; central and southern Iraq, inadequate. Therefore, the country is divisible into a Rainfall Zone in the north and an Irrigation Zone in the south. While very broadly true, this is an oversimplification of the facts.

A consideration of the "Rainfall Zone" of Iraq must be based at present upon rather inadequate statistics, since there are only thirty-odd stations regularly recording precipitation data in the country.

However, for the period 1936 to 1939 inclusive, it is possible to find data for 53 stations; consequently data for those years have been used below.[5]

Precipitation occurs in winter and spring, with five months of summer drought, and is held to be Mediterranean in origin, brought by depressions moving east along the Fertile Crescent. The regular backing of winds from northwest to southeast before the passing of the fronts indicates, however, that winds are being drawn into the centers of low pressure from the Persian Gulf, and it seems probable that the moisture content is reinforced from the Gulf and from the extensive lakes and marshes of southern Iraq. In any case it is clear that precipitation is associated with depressions moving along the Fertile Crescent. The pattern of mean annual precipitation is thus simple—the Assyrian Plains and the mountains of Kurdistan record the highest aggregates in the country owing to their location in the path of the depressions, Kurdistan recording the higher aggre-

[5] These additional stations have now ceased to function. Some, for example, were located at the oil pipeline pumping stations between Kirkuk and Haifa; now not in use. The years 1936–1939 were a typical four-year period for precipitation with two average years, one dry, and one wet year. All meteorological data used in this paper, including Figures 3 and 4, are from the Meteorological Service of the Iraq Government at Baghdad Airport.

gates of the two regions because of its elevation. There is in fact a general decrease in annual precipitation in Iraq from north and east to south and west; eventually fading out to well below 100 mm. in the western desert (Fig. 4).

The seasonality of rainfall is important, not only to the methods and timing of agricultural practices but also in pushing the limits of the Rainfall Zone of dry farming farther to the more arid southwest than might be expected from a comparison with many other countries. The winter and spring rains enable the winter-sown wheat and barley to flourish on small aggregates owing to the greater efficiency of rainfall in the period of minimum evaporation. The practice of leaving at least half the land surface fallow means that rain falling on a given area is really concentrated upon half that area, provided that it can be led to the planted sections; and, on the margins of cultivation, semi-nomadic Arabs raise sporadic crops of grain with well under 200 mm. per annum, by planting their seed in natural drainage hollows and wadi bottoms.

However, the key to the delimitation of the southward extent of the Rainfall Zone lies in an examination of mean annual aggregates. Once a minimum aggregate of precipitation necessary for cultivation has been established an isohyet can, in theory, be drawn to represent the boundary. While grain can be grown sporadically with less, 200 mm. per annum is commonly held by Iraqi geographers to be the critical limit in this respect, and can serve to mark the southward boundary of dry farming.

This, however, overlooks a vital factor in the precipitation of any region strongly affected by continentality, namely, that the annual variation is very great. Figure 3 indicates the 200 mm. mean annual isohyets for 1937 and 1939. It will be observed that the difference in position is very great. If any such isohyet is held to be a division between the Irrigation and Rainfall Zones then there exists a vast area which will fall into one zone one year and the other the next. Quite apart from any other considerations this immediately introduces a "Zone of Uncertainty," where in some years it would be theoretically possible to grow crops and in other years not at all. The Zone of Uncertainty for the period 1936 to 1939 is indicated by the shaded areas in Figure 3.

Figure 3 also indicates the southern limit of rural settlement in unirrigated areas—i.e., dependent upon rainfall agriculture. This is vital to an appraisal

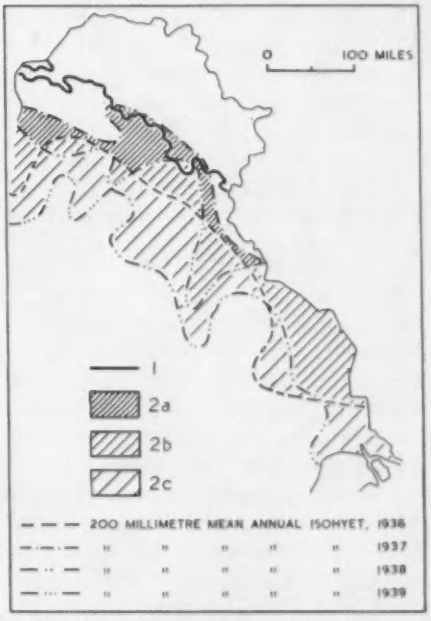


FIG. 3. The "Zone of Uncertainty." Numbers and letters refer as follows: 1, southern limit of rural settlement dependent upon rainfall cultivation. 2a, 2b, and 2c, areas with mean annual aggregates of at least 200 millimeters for, respectively, three years, two years, and one year during four-year period 1936 to 1939.

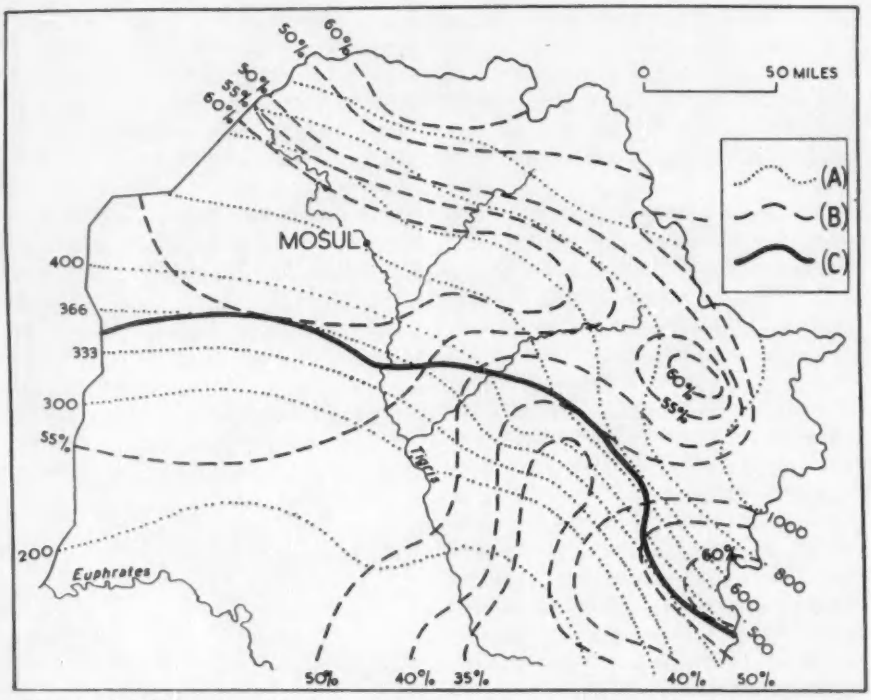


FIG. 4. Reliability of precipitation and the southward limit of the rainfall zone. Letters refer as follows: (A) isohyets for average mean annual precipitation over four-year period, 1936 to 1939. (B) isopleths for reliability of precipitation over period 1936 to 1939, the lowest mean annual aggregate expressed as a percentage of the highest for each station. (C) southward limit of zone where reliability of precipitation, plotted against average mean annual aggregate, indicates an assured minimum of 200 millimeters (over period 1936 to 1939).

of land use patterns, since virtually all cultivation is carried on by permanently settled farmers; and in Iraq there are practically no settled rural people who are not cultivators. It will be seen that the settled area is roughly limited southwards by the more northerly of the two isohyets—that for 1937—there being no settlement in the area between the two. This would seem to indicate that the Zone of Uncertainty is theoretical; the farmer has to be certain of his minimum precipitation before establishing a farm on the Assyrian Plains.[6] This strongly suggests that it is the *reliability* of precipitation which is the crucial factor in delimiting the Rainfall Zone—a point frequently overlooked. This being the case, not even the use of average annual aggregates will serve to delimit the region; account must be taken of variability in annual precipitation.

An attempt has been made in Figure 4 to determine the relation between rainfall reliability and the boundary of rainfall cultivation by this means. Using the 1936–1939 figures as a basis, the lowest annual figure for each station during that period has been expressed as a percentage of the highest figure. This gives a percentage figure of relia-

[6] This uncertainty naturally affects only the prospects of *permanent* cultivation and settlement. Semi-nomadic herding with sporadic cultivation is practiced here.

bility for each station.[7] Isopleths of reliability have then been drawn. The resultant pattern is interesting; it will be seen that reliability decreases eastwards and southwards towards the Irrigation Zone, and attains its maximum in the western section of the Assyrian Plains in the direct path of most of the depressions.

However, this is only half of the story; if, for example, an average of only 50 mm. of rain per annum falls on a station it is immaterial, in this context, whether or not the reliability is 30 per cent or 100 per cent, for the minimum figure required for cultivation is not attained. On the other hand, where an average of 700 mm. occurs, and reliability is only 30 per cent, this is still over 200 mm. Clearly, to establish a critical boundary to the Rainfall Zone, reliability must be plotted *against* average annual aggregate for the period. This has been done on Figure 4. Wherever a reliability isopleth intersects an average annual isohyet it can be determined at that point whether, during the four-year period, the annual aggregate could fall below the required 200 mm. If it could, it is outside the Rainfall Zone. Where the figure can be reduced to exactly 200 mm. is on the southern boundary of the Rainfall Zone; which has been drawn to connect all such points on Figure 4. It will be seen that this boundary correlates well with the southern limits of settlement on the Assyrian Plains (Fig. 3).

Everywhere north of this line lies in the Rainfall Zone. But this zone cuts across the cultivation pattern which would be created by considerations of terrain alone, for it includes both Assyrian Plains and Kurdistan Mountains. The factor of terrain now permits, within the Rainfall Zone so defined, extensive cultivation of winter wheat and barley in rotation and, under dry farming conditions, almost everywhere on the Assyrian Plains except for the badlands of the upfolds; and these plains are indeed a sea of crops in season, broken up by a roughly equal amount of fallow land. In the Kurdistan Mountains these winter crops, as we have seen, are restricted to valley floors and lower slopes and to the small basins. Thus the large area shown as rotation cropland in northern Iraq represents the realization of two sets of possibilities.

It will be seen further that south of the Rainfall Zone there is no cultivation across the width of the country until the neighborhood of Samarrah is reached, almost 100 miles to the south; except for some scattered strips along the riverbanks[8] and a small area around Khanaqin on the eastern frontier. Here in central Iraq, north of Baghdad, extensive cultivation begins again and continues well to the south. This is the Irrigation Zone of Iraq where river water, only slightly supplemented by winter and spring rainfall, is brought to the open fields by both lift and flow irrigation. This zone of cultivation is of course limited in extent both by the amount of water available in the rivers and by the amount which can be carried to the land; and so the zone does not extend unbroken across the width of the country as does the Rainfall Zone. In fact there are two gradually coalescing islands of cropland centered around the Euphrates and Tigris which are slowly being pushed outwards into the unimproved grazing land and other categories which surround them.[9] Here there is no

[7] For example: Mosul—highest aggregate 585 mm.; lowest 365 mm., reliability over period—$\frac{365}{585}$ x 100 equals 63 per cent.

[8] Not shown on Figure 1, which is much simplified from the original.

[9] See "Haigh Commission Report," Baghdad. Plans for the extension of the Irrigation Zone in the near future provide for the complete filling in with cropland of the tongue of negative land use now present between the southern extremities of the Tigris and Euphrates irrigation systems.

difficulty in delimiting the cropland regions. Being entirely man-made, the modern irrigation areas are exactly defined by official maps, from which this section of the land use map was largely drawn. The actual growing of crops here follows virtually the same pattern as in the Rainfall Zone—a two-fold rotation of winter sown wheat or barley and fallow, with approximately half of the land surface being fallow in a given season. Summer crops are also grown here, but occupy a relatively small percentage of the winter sown area, owing to the shortage of water in summer; and are thus masked on a land use map. The most important summer crop in southern Iraq is rice, grown at the edges of the marsh lands, particularly in the Amara district, where it is wasteful of water; followed by cotton and summer wheat and barley.

An important point which remains to be noted is that the Irrigation Zone includes certain sections classified on the map as "land rotation." These are the areas of dominant flow, as opposed to lift, irrigation; the latter being shown as "rotation cropland." This distinction was thus originally based on the difference in the nature of irrigation methods practiced, and since the actual crops grown are in both cases identical, it may appear irrelevant in this context. But in point of fact the flow irrigation areas suffer from excessive salinity of the soil, while the areas of lift irrigation do not. As has been pointed out, the apparently dead-flat floodplain of Mesopotamia presents in fact an intricate pattern of micro-relief, due mainly to the presence of confused remnants of old river terraces which marked the constantly shifting courses of the Tigris and Euphrates throughout history. Thus some parts are, to use a local term, "highlands" a meter or so above plain level; most of the surface is "lowland" or normal floodplain below the level of the riverbeds. Obviously the "lowlands" can easily be irrigated by cutting the riverbanks and allowing water to flow over the land—i.e., flow irrigation; whereas to irrigate some of the "highlands" necessitates lifting the water with pumps.

Thus where lift irrigation is required there must be a relatively lower water table and some degree of natural drainage. This, coupled with a natural tendency towards economy in the use of water where some expense is involved, means that very little salting occurs on such land. Conversely, where flow irrigation is practiced there is a tendency to waste water by pouring excessive amounts of it on the land, where it remains on the surface because of the higher water table, and because it cannot easily flow back to a river bed lying above plain level. Strong sunshine causes evaporation and excessive salting takes place. Large areas in central and southern Iraq are literally glistening white with surface salt. When this state of affairs results from human misuse the land becomes virtually useless unless "washed" by fresh water—a process which in itself demands the drainage facilities, the lack of which lie at the root of the trouble. Present authorities have duly noted this danger, and irrigation projects now go hand in hand with drainage works, but for the present, such land is abandoned and an adjoining area cultivated. The farmer does not move far away as he depends upon limited feeder canal facilities; nor does he normally move his home. Therefore this land is classified as "land rotation" on the map.

The only other areas of cropland requiring comment here are a number of small pockets along the eastern frontier with Iran—notably at the "oases" of Badra and Mandali. These

are deltaic fans at the foot of the Zagros range, where mountain streams debouch on to the plain, eventually losing themselves in saline, impermanent marshes east of the Tigris. The fans themselves support a small-scale cultivation of cereals and vegetables, as well as date palms.

Apart from cropland, the important categories of tree crops and horticulture are to be considered as positive land use, although, owing to their very fractionated appearance on the original map, the pattern on Figure 1 has been greatly simplified. In Iraq, dates are the most important tree crops; and date palms and vegetables usually grow together. Date gardens extend up the banks of the Shatt al Arab in a narrow but unbroken belt from Fao, at its mouth, to the Tigris-Euphrates confluence at Qurna. Along the Shatt al Arab these date gardens are the basis of an important export industry. Smaller areas of date gardens continue in patches up the Euphrates right to the Syrian frontier. Up the Tigris there is a similar disposition of the crop, but its cultivation begins to fade out in the vicinity of Samarrah, for reasons of temperature. Date palms are also grown along the Diyalah, the important left bank tributary which enters the Tigris just downstream of Baghdad; and along major irrigation canals in the Irrigation Zone, for example the Gharraf branch of the Tigris.

Date cultivation independent of the Tigris-Euphrates system is to be found on the aforementioned deltaic fans of Mandali and Badra on the Iranian frontier, and at a few small oases west of the Euphrates escarpment—notably at Shithatha, west of Kerbela in central Iraq. Elsewhere, however, the location of date palms is limited to narrow strips along the river and large canal banks in the Irrigation Zone where summer temperatures are high enough and water assured. There is very much greater concentration of date palms on the banks of the Shatt al Arab than elsewhere in the country. This can be explained by factors of location which have enabled the export industry to be built up here—for almost all Iraq's exported dates come from this region—which include the natural irrigation of the gardens caused by the ponding up of fresh water by tides so that the channels and creeks are naturally filled twice a day. But the most interesting feature from a land use standpoint is that everywhere in Iraq, save in the desert oases, summer vegetables are grown among the boles of the date palms. This is done in order to utilize the irrigation water fully and to take advantage of the protection afforded to the vegetables, by the palms, from sun and dust-storm. On the original land use map a combination of symbols is necessary in order to indicate this fact.

In the Rainfall Zone of the north, date palms are replaced by small orchards of deciduous fruit trees—principally apples—which are scattered around most sizable settlements but which cannot be shown on any but large scale maps. In central Iraq the growing of certain deciduous fruits and dates overlaps, but along the Diyalah river and on the banks of the Tigris around Baghdad both are rather overshadowed by the cultivation of citrus fruit trees, particularly around Ba'quba on the Diyalah. Here all three types of fruit are grown side by side, and it is normal to find that a large riverside orchard or "garden," as they are called in Iraq, grows oranges, lemons, sweet lemons, grapefruit, tangerines, peaches, pomegranates, quinces, and figs; as well as dates from the palms grown mainly for the shade and protection they afford

to the smaller fruit trees. Irrigation is almost everywhere used with fruit trees.

These types of land use together form what has been termed the positive use of land in Iraq. Cropland of both types is the key to the whole distribution; whereas tree crops and horticulture are principally located as irregular patches along waterways, often within the boundaries of the cropland zones, sometimes—notably along the Shatt al Arab—outside their limits.

The remainder, and vast majority, of the land surface of Iraq is classified on Figure 1, either as seasonal, unimproved grazing land, or as unproductive land; both of which may be thought of as disposed around the cores of cultivated land. In other words, where the possibilities of cultivation are not present or are not realized by man, as in large tracts of southern Iraq, the surface of the ground approximates its natural state. As there is everywhere an unfavorable seasonal distribution of precipitation with marked summer drought, the natural vegetation is seasonal grassland. After the ground has been watered by winter rainfall, grass and flowers grow in spring and early summer, only to wither during the summer drought. This is true almost everywhere, so that the same general category of land use is applied; but the quality of the pasture, and its season of duration, varies considerably. The best grazing on the lowlands is naturally to be found around the edges of the Rainfall Zone, and the fringes of the Irrigation Zone of cropland are also comparatively favorable, owing partly to seepage of irrigation water. Thus all the fringes of the cropland zones support large flocks of sheep and goats belonging mainly to semi-nomadic herders. It is here that the prospect of developing a modern grazing economy based on wadi-floor wells and imported grasses and breeds of sheep seem most favorable; although the necessity of settling at least some of these traditionally nomadic Arabs presents a social problem.

Going southwards and westwards precipitation declines and towards the frontiers the land is indeed semi-desert, the home of the fully nomadic Bedawin camel herders. This wide variation in quality of grazing land cannot be indicated on a map, as changes are too gradual, and there is in any case no statistical material with which to work. Therefore, the greater part of the land surface of Iraq falls into this category. At its poorest the seasonal, unimproved pastureland shades into unproductive land, and the distinction made between the two on the map is, in places, somewhat arbitrary. Patches of sandy desert in the west are clearly unproductive, but the ancient agricultural lands north of the Hor al Hammar, now long saline and deserted, are also so defined; although in a literal sense they may provide a little camel-thorn pasture for the few Bedawin herds which occasionally traverse them. But the ruins of the ancient cities of this region, such as Warka,[10] rise from what appears, from the air, to be total desert.

In these vast but poor grazing lands, the map indicates large areas of lake and marsh, which are shown together, since any distinction between them would be arbitrary. It is the contention of several Iraqi geographers that only Lake Habbaniyah, just off the middle Euphrates, and the great Hor al Hammar in southern Iraq can be classified as true—i.e., entirely permanent—lakes. The remainder are marshes for most of the year, possibly flooded land in late spring; and may on occasion be, in

[10] Also called Uruk and Erech.

part, quite dried out.[11] Essentially, of course, they represent unproductive land. The larger areas of marsh are naturally to be found in southern Iraq where rivers flow above plain level, where flood irrigation is practiced for rice growing; and where tributaries from the high Zagros Range, failing to reach the Tigris, contribute to the huge expanse of marsh east of that river.

One section of the map remains unexplained—the mountain complex of Iraqi Kurdistan. In these steeply folded mountains with their narrow valleys and gorges and small, unevenly floored basins are to be found in fractionated patterns the land use categories of rotation cropland, unimproved grazing land, scrub oak woodland and unproductive land (see Figure 5). As previously indicated, the cropland, which in its character is essentially a continuation of that of the Assyrian Plain to the south, is located on valley floors and lower slopes which are not too narrow or inaccessible; and here actual village sites are often surrounded by deciduous fruit orchards and by poplar and willow trees. The high mountain tops, owing to their excessive slopes and elevations of over 9000 feet are often bare of vegetation and rocky—unproductive land—but for the most part they have a sufficient growth of grass to be used as summer grazing in the transhumance economy of the Kurds.

On the middle slopes, between the cropland and the high mountain slope grazing land, the natural vegetation was undoubtedly woodland, completing a clearly defined altitudinal zoning of vegetation—the upper limit of trees, for example, is everywhere close to the 9000 feet contour. But the human

[11] These marshes fluctuate greatly: pending a complete cover of air photographs of southern Iraq, the boundaries shown on the base map (see Footnote 2) are here adopted as being overall the most reliable.

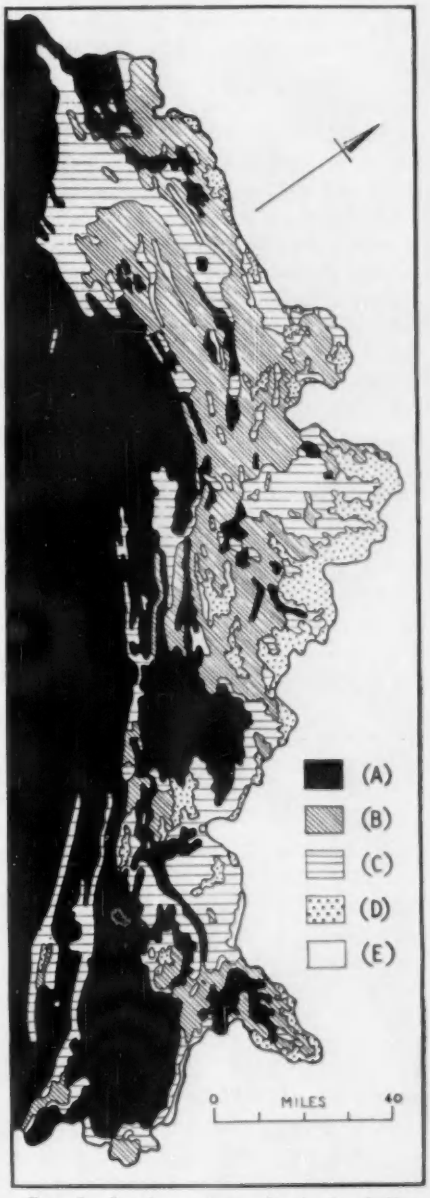


FIG. 5. Land use categories in Iraqi Kurdistan: (A) rotation cropland; (B) mountain slope scrub woodland, mainly cut-over; (C) unimproved highland grazing land; (D) generally unproductive land; (E) unproductive land. (Mainly after Chapman, "A Report on the Forests of Iraq," Baghdad.)

factors of settlement, particularly as regards accessibility, have resulted in the breaking up of the pattern on these middle slopes. Most of the woodlands, which are mainly of scrub oak, have been cut down for fuel, or over-grazed by goats and left as unimproved grazing of a special type, with the stumps of the trees left in the ground to ensure regrowth of the required fuel. At lower altitudes, cultivation has at the same time pushed the lower limits of woodlands upwards. Where human interference has been considerable, due to accessibility, only the roots of the small oak trees remain, standing on an average some 10 to 15 paces apart. Thus, despite the rather lavish use of the term "forest" in these parts, the areas of true woodland in north Iraq is limited to those mountain-slope areas remote from settlement; and in such places the concentration of the small oaks is only sufficient to justify its classification in Figure 5 as "mountain slope scrub woodland." Thus, as a result of settlement factors superimposed upon an altitudinal zoning of natural vegetation in a highland region, the land use pattern in Iraqi Kurdistan is more broken and complex than elsewhere in the country.

COMMERCE OF THE SAULT CANALS

Albert G. Ballert

Dr. Ballert, Director of Research for the Great Lakes Commission, prepared this article before becoming associated with the commission. He has long been interested in the trade of the Great Lakes and has published a number of articles on various aspects of this subject.

ATTENTION recently has been focused on the Sault or "Soo" canals—properly termed the St. Marys Falls Canals—with the completion of a century of operation. Appraisal of the commerce of the Sault at this time is desirable not only because of its venerable position among canals of the world, but also since a new peak in annual tonnage was recently established, only to have the following year bring the loss of primary position with respect to this cargo volume.

A centennial celebration was held in 1955 to mark the opening of the facilities which permit vessels to skirt the St. Marys River rapids, called by the French name "Sault" which means "leap." Two years earlier a new record was set when 128.5 million net tons of cargo traffic moved along the waterway (Table I). This climaxed a trend of 100-million-ton years which began in 1941. Since that time, even the yearly averages for each of the three five-year periods have reached totals of more than 103 million net tons (Table II).

Mention of the Sault Canals invariably calls to mind the ranking world position of this waterway, a fact learned by nearly every schoolboy. This status is commonly attested to by comparing the Sault's annual tonnage with the combined volumes of the Suez, Panama, and Kiel canals. Frequently, other waterways have been added in such a comparison for good measure. Such superlative terms no longer are valid for the Sault, although its economic and strategic values have not diminished. This evaluation of the changing relative prominence of the Sault is based on tonnage data for 1953 through 1955. In 1953 when the Sault's tonnage record was set, the Suez and Panama canals also established new records (Table III). Together, the traffic of the Suez and Panama totaled about 19 million net tons in excess of the Sault's volume for that year. This was followed in 1954, the hundredth season of operation for the Sault and an abnormally low one in traffic, by the Suez alone surpassing the Sault by over 21 million net tons (Table III). In 1955, the margin of victory for the Suez was narrowed to about 4 million tons. With the continuing expansion of the traffic in Middle East oil through the Suez, it appears questionable whether the Sault can regain, even for an occasional year, the position it held so long. [Note: The sunken vessels blocking the Suez Canal as a result of the recent conflict will, undoubtedly, return the Sault to first position for 1956.] In appraising the canals it should be recognized, however, that the toll-free Sault locks operate not more than nine months of the year—about 8¼ months in 1955—whereas the 100-mile long lockless Suez never closes because of climatic conditions.

Since 1919, five locks have been

TABLE I

ORIGIN OF COMMERCE THROUGH THE SAULT STE. MARIE CANALS: 1953

(Net tons)

	Total	Eastbound		Westbound		
		U. S.	Canadian	U. S.	Canadian	Overseas
All traffic	128,510,232	102,141,546	14,578,377	11,198,751	587,697	3,861
Iron ore	98,580,064	96,112,546	2,234,279	233,239	.....	.....
Grains, total	13,332,604	2,374,676	10,912,081	45,847	.....	.....
Wheat	8,110,588	1,787,880	6,276,861	45,847	.....	.....
Barley and rye	2,898,894	56,727	2,842,167	.....	.....	.....
(Barley*)	(2,450,203)	(47,947)	(2,402,256)	.....	.....	.....
(Rye*)	(448,691)	(8,780)	(439,911)	.....	.....	.....
Oats	1,597,999	968	1,597,031	.....	.....	.....
Corn	409,703	409,703	.....	.....	.....	.....
Flaxseed	290,949	119,398	171,551	.....	.....	.....
Other	24,471	.....	24,471	.....	.....	.....
Coal and coke, total	8,949,679	.....	5,000	8,944,679	.....	.....
Bituminous coal	8,692,946	.....	5,000	8,687,946	.....	.....
Anthracite	93,090	.....	.....	93,090	.....	.....
Coke	163,643	.....	.....	163,643	.....	.....
Petroleum products	3,975,000	3,370,649	6,788	395,009	202,554	.....
Crude†	3,370,649	3,370,649	.....	.....	.....	.....
Gasoline	298,981	.....	3,000	204,976	91,005	.....
Fuel oil	227,594	.....	3,788	129,179	94,627	.....
Other	77,776	.....	.....	60,854	16,922	.....
Limestone	1,271,059	.....	.....	1,271,059	.....	.....
Products of wood	708,266	28,075	672,970	.....	2,360	3,861
Pulpwood	492,413	28,075	464,338	.....	.....	.....
Wood pulp	89,618	.....	85,757	.....	.....	3,861
Newsprint paper	122,840	.....	122,840	.....	.....	.....
Other	3,395	.....	35	.....	3,360	.....
Iron and steel products	589,485	244,739	305,030	35,526	4,190	.....
Motor vehicles	62,947	.....	270	57,468	5,209	.....
Salt	76,259	.....	.....	60,949	15,310	.....
All other	964,869	10,861	441,959	154,975	357,074	.....

*Estimated breakdown based on data in files of Corps of Engineers.
†Canadian crude shipped from Superior, Wisconsin, to Sarnia, Ontario.
Source: Corps of Engineers, U. S. Army, Great Lakes Regional Statistical Office, Chicago.

available to accommodate the vast lake carrier traffic to and from Lake Superior. Four of these are at the American canal and one at the Canadian. Through the American locks normally passes about 97 per cent of the freight tonnage and 75 to 80 per cent of the vessels. In the peak traffic year of 1953, over 26,000 vessel passages were reported for the five locks (Table III). Passenger ships commonly use the Canadian facility. A new high in this business was set in 1955 when the passenger traffic in each direction totaled over 91,000 persons.

While the huge total freight tonnage gives the Sault canals their world-wide fame, the volume and trends of the various commodities making up this flow reflect a great deal about the economy and resources of the United States and Canada. It is to the principal commodities in this traffic that attention is centered. Before con-

TABLE II

PRINCIPAL COMMODITIES IN THE COMMERCE OF THE SAULT CANALS
5-YEAR AVERAGES 1916–1955 AND ANNUAL 1940–1955

(Net tons)

Year(s)	*Total*	*Iron ore*	*Coal and coke*	*Wheat and other grain*	*Petroleum and products*
1916–20	82,980,096	57,816,157	16,086,958	.....	312,963
1921–25	71,923,734	44,109,233	13,811,955	11,655,177[a]	211,963
1926–30	84,309,183	54,607,496	15,261,518	11,069,750	307,421
1931–35	39,188,775	20,464,457	9,122,734	6,624,997	484,430
1936–40	71,282,724	49,156,463	10,799,863	7,107,477	800,373
1941–45	115,478,745	84,736,600	14,338,940	12,342,831	851,213
1946–50	103,941,029	75,985,350	14,245,019	9,486,940	1,023,661
1951–55	110,924,646	83,312,511	9,278,641	11,910,910	2,634,543
1940	89,858,319	66,226,030	10,269,860	8,107,035	1,042,931
1941	111,121,684	83,151,024	12,309,058	10,487,350	1,014,215
1942	120,199,479	94,326,578	13,210,834	8,105,453	773,915
1943	115,851,903	85,583,376	15,881,954	10,816,603	814,967
1944	117,238,031	82,006,592	16,432,258	14,732,075	770,454
1945	112,982,630	77,815,433	13,860,597	17,572,674	882,512
1946	91,586,895	61,976,643	15,943,492	9,512,874	1,244,082
1947	110,731,572	80,788,754	15,833,229	9,936,178	939,790
1948	115,414,277	85,255,779	16,879,512	8,907,970	1,043,927
1949	95,831,997	71,663,596	8,940,583	10,992,605	1,094,517
1950	106,140,406	80,241,977	13,628,280	8,085,074	845,990
1951	119,864,396	90,275,138	10,765,641	12,064,668	2,849,413
1952	106,275,645	75,727,017	10,001,891	13,328,591	3,716,834
1953	128,510,232	98,580,064	8,903,994	13,262,286	3,975,000
1954	85,417,658	62,583,469	7,445,340	10,712,720	1,268,292
1955	114,555,298	89,396,865	9,399,299	10,186,284	1,363,174

[a] Average for 1923–25. Prior to 1923 data on the volume of wheat and other grains was available only in bushels.

Source: Corps of Engineers, Detroit District, *Statistical Report of Lake Commerce Passing Through Canals at Sault Ste. Marie, Michigan and Ontario.*

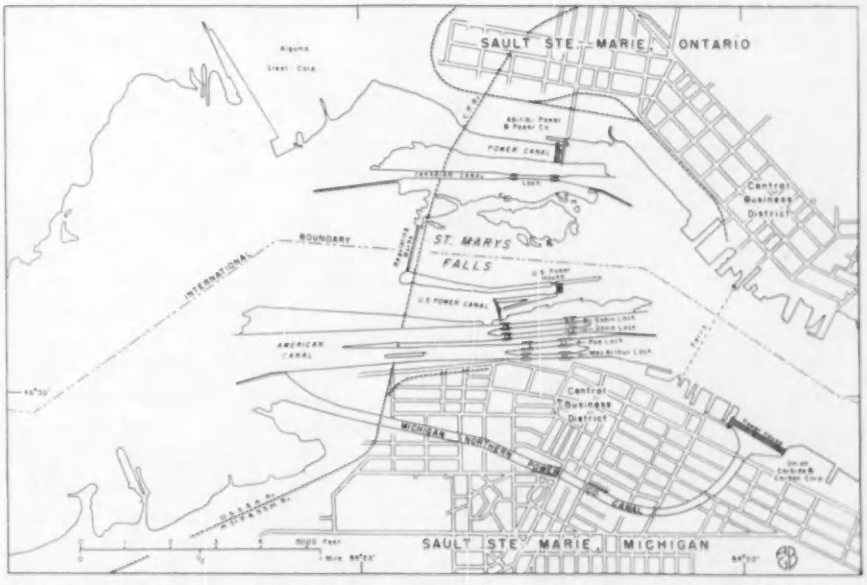


FIG. 1. Five locks are available to accommodate the lake carrier traffic to and from Lake Superior. Elevation of the St. Mary's River above the locks is 601 feet (low water datum) and below the locks it is 579 feet above mean tide at New York City.

sidering them individually, however, several facts of a broader nature merit mention.

One feature is the directional flow of freight through the Sault canals. It is grossly unbalanced with from 85 to 90 per cent of the tonnage being eastbound (Tables I and III). This condition is closely related to the dominant role which iron ore has always played in the yearly nine-month drama at the Sault. Grains lead the supporting cast, only recently having replaced the other principal—coal.

The activity at the Sault in ore and grain provides a good indicator of the total Great Lakes traffic in these commodities. With the Sault lying along the low-cost water route between the principal sources of these products and their major markets, well over 90 per cent of the total shipments of each commodity on the Lakes is included in the Sault traffic.

When the tonnage record for the Sault was set in 1953, it was primarily the result of a new high in the iron-ore traffic. New peaks also were reached, however, in the movement of petroleum products and in grains other than wheat. It appears that the future traffic in petroleum products will likely not be more than a third of the 1953 figure for reasons mentioned later. This situation, plus the declining coal trade, makes it highly questionable whether the Sault's 1953 record of 128.5 million tons will ever be surpassed. The nearest approach to it was in the war year, 1942, when the total was 120.2 million tons (Table II).

In this study, the 1953 commercial statistics are the principal data utilized (Table I). This period permits a breakdown of the Sault's commodity traffic by country of origin for the year of peak commerce. The high volume in 1953 did not, however, unduly affect the relative importance of the various products in the trade. Abnormally low ore and coal traffic in 1954 makes this an unsatisfactory period to evaluate.

TABLE III

TRAFFIC OF THE SAULT, SUEZ, AND PANAMA CANALS: 1953–1955

(Net tons in 000's)

Canal	*Year*	*Total*		*Principal direction*		*Secondary direction*	
		Tons	*Transits*	*Tons*	*Transits*	*Tons*	*Transits*
Sault	1953	128,510	26,122	116,720	13,049	11,790	13,073
	1954	85,418	17,405	75,218	8,621	10,200	8,784
	1955	114,555	22,525	101,685 (eastbound)	11,272	12,870 (westbound)	11,253
Suez	1953	99,647	12,731	74,825	6,369	24,822	6,362
	1954	106,792	13,215	82,133	6,586	24,659	6,629
	1955	118,506	14,666	96,370 (northbound)	7,334	22,136 (southbound)	7,332
Panama	1953	47,888	8,850	25,933 (westbound)	4,537	21,955 (eastbound)	4,313
	1954	45,098	8,256	23,953	4,185	21,145	4,071
	1955	50,035	8,397	26,947 (eastbound)	4,152	23,088 (westbound)	4,245

Sources:

Sault: Corps of Engineers, U. S. Army, Office of the District Engineer, Detroit District.

Suez: Compagnie Universelle du Canal Maritime de Suez, *Le Trafic du Canal de Suez. Année 1955.* (Original data in metric tons.)

Panama: Letters from Panama Canal Co., Balboa Heights, Canal Zone, August 3, 1954, July 11, 1955, and April 12, 1956. (Original data in long tons.)

FIG. 2. The four American locks on the St. Mary's River looking west. At the right center is the St. Mary's Falls, and at the far right is the entrance to the Canadian canal. Beyond it is the Algoma Steel Company plant. (Compare with Figure 1.)

Detailed information for 1955, the median year among the last five, is not presently available.

THE IRON-ORE TRADE

The Sault canals were initially built for the all-water transport of iron ore. Since the second year of operation this resource, so essential to America's industrial strength, has led continually in traffic volume.[1] The basic role of iron and steel in our economy has made fluctuation in the ore trade through the years an excellent indicator of our industrial activity and national prosperity.

Without the iron-ore traffic, the Sault would fall well below its two chief competitors in tonnage. Currently the flow of ore represents about three-quarters of the total volume. In the peak year of 1953, the figure was 77 per cent, and, for the 1951–55 period, it averaged 75 per cent.[2] During the depression years of 1931–35, however, the tonnage fell to 52 per cent of the total (Table II).

The value of ore passing through the Sault Canals indicates why this narrows in the Great Lakes trade route has been referred to as "The Billion Dollar Mile."[3] Converting the 1953 ore traffic

[1] In 1855, copper and general merchandise were greater.

[2] A new monthly record was set in August, 1953, when the volume reached nearly 15.5 million net tons or one-half million tons per day. This volume, measured in rail cars, would mean one 70-ton car passing the Sault every 12 seconds throughout the month.

[3] Dwight Boyer: "The Billion Dollar Mile," *Steelways*, October, 1954, p. 1.

of 98.6 million net tons into gross tons of $10 per unit shows the value of this commerce to be more than 880 million dollars.

The marked year-to-year variance in the ore trade has been well illustrated during the last several navigation seasons (Table II and Fig. 3). In 1952, the volume was 75.7 million net tons. This figure, about 15 million tons below that of the previous year, was largely due to the steel strike in mid-summer. The 98.6 million ton record year that followed was a result of depleted stock piles at the mills and the anticipated needs for an expanding market.[4] When steel output dropped to less than two-thirds of capacity in the summer of 1954, a sharp decline occurred in the Sault ore traffic. Accompanying a decrease in volume of 36 million tons or 37 per cent below 1953 was the laying up for the winter of many ore boats in the early fall, although only 80 per cent of the fleet began operations during the season.[5]

In the 1955 navigation season, the Sault ore traffic made a sharp recovery, increasing 43 per cent over the previous year's 62.5 million net tons. Expansion in steel output began in the fall of 1954, and this resulted in low stocks of ore at lower lakes ports and at the steel mills when the 1955 navigation season opened. High production of steel continued, and from September, 1955, until the steel strike in July, 1956, it was at a rate of more than 95 per cent of capacity.[6] Through June, 1956, the ore traffic at the Sault was about 3.5 million tons above that of the previous year at this time, and it appeared a near-record year might be attained. At the end of July, however, the effects of the strike placed the 1956 volume more than 7 million tons below the same period in 1955.[7] As of August, 1956, it appeared likely that the Sault ore trade for the current year would be about 80 million tons.

Several factors will play a role in the future ore traffic of the Sault. Of prime consideration are the prospects of the Lake Superior ore district. On this matter, pessimism does not appear warranted either on the basis of the extent of iron reserves in the area tributary to Lake Superior or due to the increasing importation of Labrador, South American, and other foreign ores. A favorable view with respect to reserves is based on the expanding ore production of the Canadian segment of the Lake Superior District and the vast extent of magnetic taconite and jasper which are just beginning to be processed in the American sector. The taconite concentrates moving through the Sault in volume in the near future will mean ore with greater iron-producing potential per ton (64 per cent iron).[8]

The volume of foreign-mined ore entering the United States in the last five years has been as follows (in millions of net tons): 1951—11.4, 1952—10.9, 1953—12.4, 1954—17.7, and 1955—

[4] The United States produced 133.5 million net tons of iron ore in 1953, more than in any previous year, and Lake Superior ranges accounted for 81 per cent or 107.6 million tons of this total. (American Iron and Steel Institute, *Steel Facts*, April, 1954, p. 4.)

[5] *Wall Street Journal*, November 3, 1954.

[6] The annual steel production in January, 1956, was 128.4 million net tons. March, 1956, was marked by the nation's steelmaking furnaces reaching their greatest production in history—10.9 million tons.

[7] Based on the monthly "Statistical Report of Lake Commerce Passing Through Canals at Sault Ste. Marie, Michigan and Ontario," April–July, 1956 issues, Detroit District, Corps of Engineers (Mimeographed).

[8] It should be noted that the Lake Superior District ore shipments of the port of Escanaba do not affect the Sault's eastbound ore traffic. In 1953, the volume was 6.8 million net tons. However, about one-quarter million tons of this total moved westbound through the Sault to the Algoma Steel Company in Sault Ste. Marie, Ontario.

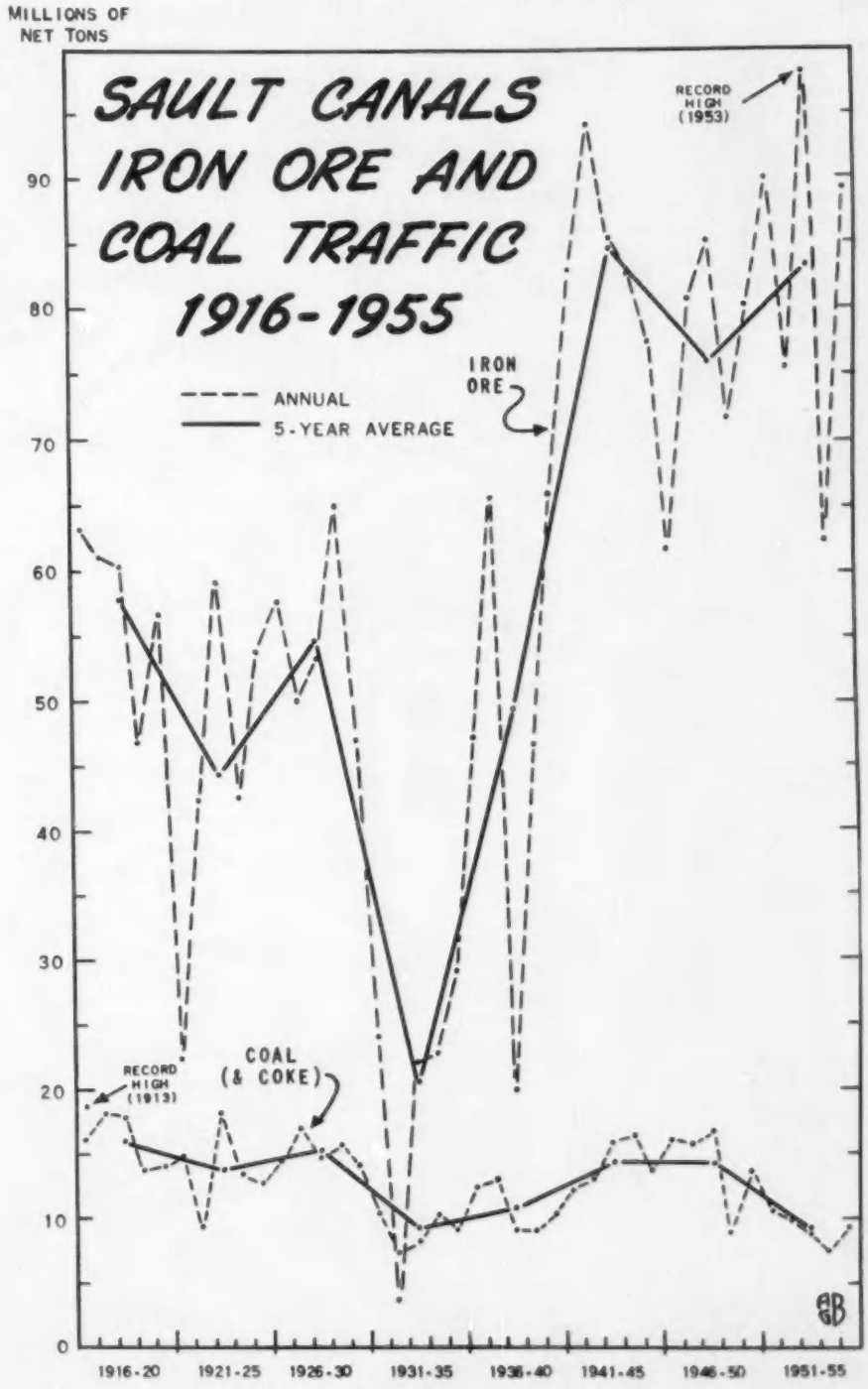


FIG. 3. Forty years of iron ore and coal traffic.

26.3.[9] These ores will be used primarily along the eastern and Gulf coasts except for those from Canada. With respect to the Quebec-Labrador ore, the foreseeable maximum volume coming to the lower lakes docks is 8–9 million tons—in 1955 the St. Lawrence canals handled 1.75 million net tons of ore. This should relieve some of the pressure for ore via the Sault, but it appears that the impact will be minor. The remainder of Canada's export ores follows the Sault route, being shipped from Port Arthur (Steep Rock mines) and Michipicoten. Accompanying the rise in ore imports is the nation's increase in steelmaking capacity. From 1950 to 1956, for example, the capacity rose from 99.4 to 128.4 million net tons, a gain of nearly 30 per cent. Plans of the steel companies indicate a further expansion of 15 million tons in the next three years.[10] Hence, it appears that there will be a demand for full production of Lake Superior iron resources to meet the needs of our expanding market.

THE GRAIN TRADE

Through the Sault funnels a major portion of the agricultural wealth of our northern Great Plains and the Canadian Prairie provinces. From this district, the world's leading grain producer, comes a variety of products. So great is the aggregate volume of grains shipped eastward from the twin ports of Fort William–Port Arthur and Duluth-Superior that, since 1951, they have placed second in the traffic of the Sault, accounting for 9 to 13 per cent of the total tonnage. The grain shipments from these ports accounted for 96–97 per cent of total Great Lakes tonnage of such products in 1953 and 1954.[11]

Among the six principal grain products (including flaxseed) in the commerce of the Sault, wheat holds a commanding position (Table I). It being the heaviest of the group, the disparity has been somewhat greater with respect to tonnage (60 per cent of the total in 1953) than volume (53 per cent). It should be noted, however, that the recent gains of other grains in lake commerce now places wheat at its lowest point in relative importance. In 1953, grains other than wheat reached a new peak of 5.2 million tons.

The grain trade of the Sault began in the early 1870's with the development of Duluth as a shipping point for our western grains. Growth was rapid and further momentum was provided by the opening of terminals at Ft. William–Port Arthur in 1908–9.[12] These Canadian twin ports have continued to expand and now lead in the shipments of all grains except corn. In 1953, the ports contributed 82 per cent of the total grain moving through the Sault (Table I).[13] In addition, they shipped barley, rye, and oats to Duluth-Superior—over one-third of a million tons in 1953.

Seasonal activity in the Sault's grain traffic has a somewhat different pattern than that of other commodities. Particularly in the movement of wheat, the peak is usually reached as the end of the navigation season approaches. This results from the relatively late harvest season and the desire to move as much of the season's crop as possible to eastern elevators by low-cost water transport.

[9] American Iron and Steel Institute, *Steel Facts*, April, 1956, p. 2.
[10] *Steelways*, June, 1956, p. 1.
[11] News release of the Lake Carriers' Assn., Cleveland, January 7, 1955.
[12] Lake Carriers' Assn., *The Bulletin*, Vol. 40, October, 1951, p. 20.
[13] Based on data from Corps of Engineers, U. S. Army, *Water-borne Commerce of the United States, Calendar Year 1953, Loc. cit.*, pp. 52f.

A question arises regarding the effect of the St. Lawrence Seaway on the grain trade. It appears certain that few overseas vessels will pass through the Sault to obtain grain cargoes.[14] Rather, the lake carriers, having greater capacities, will make longer trips, chiefly to Montreal.[15] Eliminating the necessity for transfer to rail or smaller vessels at Lower Lakes ports will mean considerable savings. It is, in fact, the foreseen benefits of the Seaway to the Canadian grain trade that have weighed heavily in the Dominion's support of the project.

It should be noted that not all of the eastbound grain of Canada moves through the Sault. Minor portions are shipped all-rail eastward and by rail to Churchill on Hudson Bay. In 1953, the volume to this northern port was about 11 million bushels.[16]

THE COAL TRADE

Coal has historically ranked second in annual volume among the commodities in the traffic of the Sault. However, the amount has declined in recent years (Table II and Fig. 3), and second place has not been attained since 1950. Nor does it appear likely that this status will be regained. In the westbound traffic of the Sault, where coal accounts for about three-quarters of the total volume, the relative importance of this commodity does not appear to be threatened in the foreseeable future.

In 1953, when the Sault traffic record was established, the coal segment of this flow dropped to its lowest volume since 1906 except for the depression years of 1932 and 1933. The following year saw a further loss of 1.5 million tons, but in 1955 this was offset by a gain of 2 million tons. For 1956 a 10 million ton year appears a certainty, but continuance of the commodity movement at this level is doubtful.

The Great Lakes coal trade has shown a trend similar to that of the Sault, but the decline in the flow to the Lake Superior area has been more marked. This is illustrated during the last five years by comparing the Sault's traffic with shipments from Lake Erie ports, the principal source of the coal which passes through the Sault. Lake Erie bituminous coal and anthracite loadings ranged from 50.9 million tons in 1950 to 39.6 million in 1954, for a decrease of 22 per cent. Between these years, the flow of coal through the Sault fell from 13.6 to 7.4 million tons or about 45 per cent (Fig. 3).[17]

To what is the sharp decline in Lake Superior coal requirements attributed? Oil is the key factor. Until recently, the increasing demand for this liquid fuel has been supplied by terminals on the Lower Lakes. Development of the petroleum deposits of western Canada in the late 1940's, however, has diminished the prospects for the Sault even to gain much tonnage in this alternative fuel.

Activities which may bring some upturn in the future coal trade of the Sault are the development of additional steam generating plants to meet increasing power needs and the expanding industry to beneficiate taconite.

[14] In 1953, the direct trans-Atlantic grain shipments from Lake Superior totaled about 1 million bushels. (Lake Carriers' Assn., *Annual Report, 1953*, Cleveland, 1954, p. 112.)

[15] A typical 600-foot lake freighter can carry about 420,000 bushels of grain. At an average of 16 bushels of wheat per acre, this volume represents the harvest of 26,250 acres or 41 square miles.

[16] Dept. of External Affairs, *Canadian Weekly Bulletin*, March 12, 1954, p. 6, and *Annual Report of the National Harbours Board*, for Calendar Year 1953, Ottawa, 1954.

[17] The anthracite portion of the 1954 shipments from Lake Erie ports was 284,000 tons, and the Sault volume was about 48,000 tons. For an appraisal of the coal trade of the Lakes, see Albert G. Ballert: "The Great Lakes Coal Trade: Present and Future," *Econ. Geog.*, Vol. 29, 1953, pp. 48–59.

Accompanying the long-term trend in the Lake Superior coal market are the year-to-year factors affecting demand. The length and severity of the winter is a prime consideration here. The tempo of industrial activity is another.

As the coal receipts of the Lake Superior area have dwindled, it has meant an increase in the number of vessels upbound in water ballast. This procedure is used particularly by the newer and larger freighters in order to avoid the delay required in unloading coal. An outstanding example of this one-way vessel traffic is provided by the "Joseph H. Thompson." When the writer was aboard this 714-foot lake giant on its sixty-first trip to the head of the Lakes (June, 1954), he learned that this oil-fired bulk carrier had not handled a ton of coal since being commissioned in 1952.

ADDITIONAL MILLION-TON COMMODITIES

Besides the three major commodities moving through the Sault, two others—petroleum products and limestone—each exceeds a million net tons annually. The Sault traffic in these products, as in the case of coal, however, represents only a small portion of their total volume carried on the Great Lakes.

Petroleum Products—Tankers vs. Pipe Lines

Petroleum is the commodity which most recently has illustrated the dynamic nature of the Sault traffic. Through the 1950 season, the volume of various petroleum products never had exceeded 1¼ million tons (reached in 1946), and this was entirely a westbound movement. However, the opening of navigation in April, 1951, saw an abrupt change in the tonnage and directional flow of this product (Table IV).

Completion of the Interprovincial pipe line from Edmonton, Alberta, to Superior, Wisconsin, provided an outlet to the Great Lakes for the vast new Canadian oil supply. This eastbound movement of crude petroleum raised the Sault traffic in petroleum products by more than 2 million tons annually to a total of 2,850,000 tons for the 1951 navigation season. Further expansion occurred in 1952, and in 1953 the total volume was nearly 4 million tons, although the westbound flow showed some decline. Reaching a peak at this time, petroleum products contributed

TABLE IV

PETROLEUM TRAFFIC THROUGH THE SAULT CANALS AND VIA THE SUPERIOR-SARNIA PIPE LINE: 1950–1955*

(Net tons)

Year	*Via the Sault (tanker)*			*Via pipe line eastbound*
	Westbound	*Eastbound*	*Total*	
1950	845,990	.....	845,990	.....
1951	823,695	2,025,718	2,849,413	.....
1952	744,741	2,972,093	3,716,834	.....
1953	597,563	3,377,437	3,975,000	.....
1954	630,294	637,998	1,268,292	4,492,131
1955	752,634	610,540	1,363,174	4,868,463

*Sources: Sault—Corps of Engineers, *Statistical Report of Lake Commerce Passing Through Canals at Sault Ste. Marie, Michigan and Ontario* (annual reports for 1950–1955).

Pipe line—Dominion Bureau of Statistics, Public Finance and Transportation Division, letters from G. A. Richardson, Chief, Jan. 24, 1955, and Jan. 27, 1956 (conversion factor, 6.973 barrels per ton).

significantly to the 1953 record traffic of the Sault. Its trend since that time is one of the factors bringing about the conclusion that the peak traffic year for the Sault has been reached.

During 1953, a pipe line was extended 643 miles from the head of the Lakes eastward through Wisconsin and Michigan's upper peninsula to the Straits of Mackinac and on to Sarnia, Ontario. Its purpose was to obviate the seasonal factor present in the lake tanker operation. Opening of this facility, the world's longest continuous crude oil pipe line (1765 miles from Edmonton to Sarnia), in January, 1954, also meant a sharp decline in the petroleum movement through the Sault. In 1954, the eastbound tanker volume fell 2.7 million tons below that of the previous year. Table IV shows the changes which have taken place in the period between 1950 and 1955.

Several points worthy of noting with respect to the tanker–pipe line petroleum transport competition are: (1) at the peak of eastbound tanker movement in mid-1953, the volume was nearly 500,000 net tons per month; (2) the pipe line monthly volume in 1954 averaged about 375,000 tons (about 3,000,000 tons during the Lakes navigation season), but it has a capacity of more than 500,000 tons per month; (3) since the opening of the pipe line, two of the several ocean-sized tankers (620 feet overall) on the Great Lakes have been converted to other uses, and one such tanker has gone into the ocean trade.

FIG. 4. Pulpwood moving eastward through one of the locks in the American canal at the Sault. (Photo by Elmer Eckroad, Sault Ste. Marie, Michigan.)

Limestone

Like coal, limestone enters only into the westbound traffic of the Sault Canals. Since the 1940's, this movement has been over a million tons a season. Remaining under one and two-third million tons, however, makes this but a small segment of the Great Lakes limestone trade, which reached a new peak of 29.7 million net tons in 1955. Leader among the users of limestone is the iron and steel industry, an activity in which the Lake Superior area plays a relatively minor role. Nevertheless, the limestone needs Duluth and Sault Ste. Marie, Ontario (above the Sault locks) must be obtained from the Lake Huron area, the principal source of high-quality limestone for flux in blast and steel furnaces. With future tonnage related so closely to an industry which shows little likelihood of major expansion above the Sault, it appears that the annual volume up the St. Marys River will remain under 2 million tons.

OTHER SIGNIFICANT PRODUCTS

The remaining commodities in the Sault traffic all have annual volumes of less than a million tons. Several in this group, while contributing in only a minor way to the tonnage status of the Sault, warrant some appraisal. Included in this group are automobiles, iron and steel, and wood products.

Wood Products

Most important in tonnage is the wood products group which has totaled over 600,000 tons in most postwar

FIG. 5. A freighter loaded with automobiles destined for Duluth and Superior. (Courtesy of Lake Carriers' Association, Cleveland.)

years. This is entirely an eastbound movement with the bulk of the traffic originating at Canadian ports (Table I). Pulpwood is the principal commodity, followed by newsprint paper and wood pulp (Fig. 4). The major portion of this traffic is destined for American ports. Whether the flow of these products will increase is not a matter of adequacy of supply, for Canada's coniferous forests are vast. Rather, the factor is one of competition from other sources of supply.

Iron and Steel

Another commodity group which moves largely eastbound and in significant volume is iron and steel. With the Lake Superior area lying well outside the American Industrial Belt, the direction of this flow may appear contrary to expectation. The tonnage is, however, made up largely of pig iron and scrap iron. The former is produced at Sault Ste. Marie, Ontario, and at Duluth. With westbound iron and steel reaching 200,000 tons in 1955, the total Sault traffic for the commodity group finally by a narrow margin achieved a million tons.

Automobiles

Last of the products to be mentioned in the Sault commerce are automobiles. Although the total tonnage is low, this deck cargo holds the leading position in value per ton. Placed aboard freighters in the Detroit-Windsor area, the new cars are carried to western Lake Superior's twin ports (Fig. 5).[18] The high point in this traffic was reached in 1950 (75,710 tons) when automobile sales also set a new record. Based on an average weight of 1.75 tons per car (U. S. Corps of Engineers figure) indicates the 1953 traffic of 62,677 tons represented about 35,800 units. If valued at an average of $2000 per unit, this lake traffic had a total worth in 1953 of more than $71 million. In 1954, the traffic declined 52 per cent from the previous year's total, although national registrations of new cars for the first 11 months of 1954 fell only 8 per cent.[19] This variance is explained by the fact that only one major automobile producer (Chrysler) utilizes the Sault route. The 1954 eleven-month registrations of this company were 42 per cent below the 1953 figure, thus correlating quite closely with the decrease in autos carried through the Sault. As the business of Chrysler goes, so goes the Sault's automobile traffic.

[18] Converted freighters having several decks are used to transport new cars from Detroit to Buffalo and Cleveland.

THE OUTLOOK

As the Sault waterway enters its second century of operation, the traffic outlook appears favorable. In the future, its status among the major canals of the world will undoubtedly remain as closely related to the trend of the iron ore trade as it has in the past. This, of course, makes the prospects for the Lake Superior ore district a key question. The expanding Canadian ore production in this area and the start of processing taconite and jasper by a number of American companies provide a bright note. Competition from foreign ores is another, less favorable, factor. However, whatever effects this may have on the Sault ore traffic should be viewed as a relief for the Lake Superior ore district from the heavy drain which continually has been placed upon it rather than as a sign of dwindling reserves. Our expanding American economy, aided by substantial population

[19] Eleven-month registration data was obtained from *Automotive News*. This period was used since few cars are transported toward the end of the navigation season.

growth, will require additional supplies of foreign and domestic ore.

There will be other low-volume years in the ore trade on our Inland Seas like that of 1954, this resulting from cyclical economic conditions. The potential of the Lake Superior District continues high, however, and may produce a 100-million-ton ore season for the Sault, a mark which was nearly attained at the end of the first century of operation (1953). But whether the total tonnage record set in that year can be matched is doubtful, for the coincidence of such high volumes in a number of commodities seems unlikely to be repeated.

The commodities other than ore, which in their aggregate account for about a quarter of the Sault tonnage, have one faltering member. This is coal. It appears that the flow of this commodity will hold at about its present volume. The situation may improve if the increasing demand for power, which is taking place in most sections of the nation, continues and expands in the areas served by Lake Superior ports.

What effect the St. Lawrence will have upon the commerce of the Sault is undoubtedly a question of high current interest. It would appear quite certain to be minor in both relative and absolute terms, since only package freight and general cargo trade seem likely to offer any new commerce.[20] Because the great magnitude of the present tonnage would dwarf any prospective overseas traffic and the hinterlands of the American ports on Lake Superior do not hold many large or expanding population centers, the prospective volume of imports and exports is limited. Recent developments in the Canadian Prairie provinces make their future for generating general cargo trade via the Sault less predictable. The grains from this region seem certain to move eastward over the Lakes in the specialized lake carriers all the way to Montreal or to transfer points on the lower lakes. Their marked advantage in carrying-capacity over an ocean vessel of similar draft assures the lake freighter of most of this important Sault traffic.

The increasing capacities of the lake carriers will result in fewer vessel passages through the Sault without a necessary decrease in tonnage. This is exemplified by the increase in average cargo of ore boats in recent years. In 1949, the figure was 10,865 gross tons; by 1954, this had risen to 12,802 tons.[21]

[20] In 1955, eight vessels other than American and Canadian entered Lake Superior. They carried 4558 net tons of cargo to Lake Superior ports and 4043 tons from these ports (Letter from Frank R. Heselton, Assistant Chief, Lock Operations Branch, Corps of Engineers, Sault Ste. Marie, Mich., August 6, 1956).

[21] Lake Carriers' Assn., *Annual Report, 1953*, p. 71, and *1954*, p. 70. In years of low water levels on the lakes these averages may decline due to the necessity for shallower vessel drafts. The recently approved deepening of connecting channels in the Great Lakes to 27 feet will alleviate this situation.

LORRAINE AND THE RUHR

N. J. G. Pounds

Dr. Pounds is Professor of Geography and Chairman of the Institute of East European Studies at Indiana University. His "The Ruhr: A Study in Historical and Economic Geography" was published by the Indiana University Press in 1953.

THE existence within 150 miles of each other of one of the richest of Europe's coal fields and the most extensive of her iron ore fields must tempt speculation on their mutual relationship. It has been stated not infrequently that they belong naturally each to the other, and this supposition has led to vague generalizations upon the economic unity of Lorraine and the Ruhr.[1] It might seem that the Ruhr and Lorraine would have supplemented each other's deficiencies in coal and iron ore. There have, it is true, been tendencies towards such an exchange of materials, but always strong forces—political, commercial, and, above all, technological—have worked to break up such an economic union. A system of exchange as simple and as complete as, for example, that which unites the industrial area of the southern Urals with the Kusbas has never at any time existed between Lorraine and the Ruhr. It is the purpose of this paper to examine the extent to which, at various times, the Ruhr and Lorraine have in fact each supplied the needs of the other, and describe the commercial patterns that have existed between them.

Iron working is of a considerable antiquity in both Lorraine and the Ruhr. Iron smelting began in the latter in the early years of the 18th century, when bog ore, dredged from the marshes of Westphalia, was smelted with charcoal from the local forests. As the supply of bog ore grew smaller, it was supplemented and then replaced by the ores from the Siegerland. It was not, however, until 1849 that coke, prepared from the vast local reserves of coal, was first used successfully to smelt the ore. The impetus which this gave to the iron industry quickly exhausted the supplies of bog ore. A coal measures iron ore, obtained from the local mines and supplemented by richer ores from the Siegerland, replaced the bog ore, and was smelted in the 1850's and 60's in an increasing number of furnaces. Some ores, suitable for the Bessemer process, were imported from Spain, Italy, and elsewhere, but to most observers in the middle years of the century there seemed as little likelihood of a shortage of iron ore in northwestern Germany as there was of a lack of coal.

There was no reason why the Ruhr industrialists should require ore from Lorraine at this time, nor was there any

[1] Statements of this kind in textbooks are legion. On a higher plane W. E. Ogburn and W. Jaffe: *The Economic Development of Post-War France*, Columbia University Press, 1929, p. 31, states: "A natural system of exchange was . . . set up between Lorraine, sending out iron ore and pig iron, and Westphalia sending in return coal and coke. . . . The new . . . Franco-German frontier ran, however, right across and intercepted the trade routes taken by Lorraine iron going to the Ruhr and by Westphalian coal and coke consigned to Lorraine."

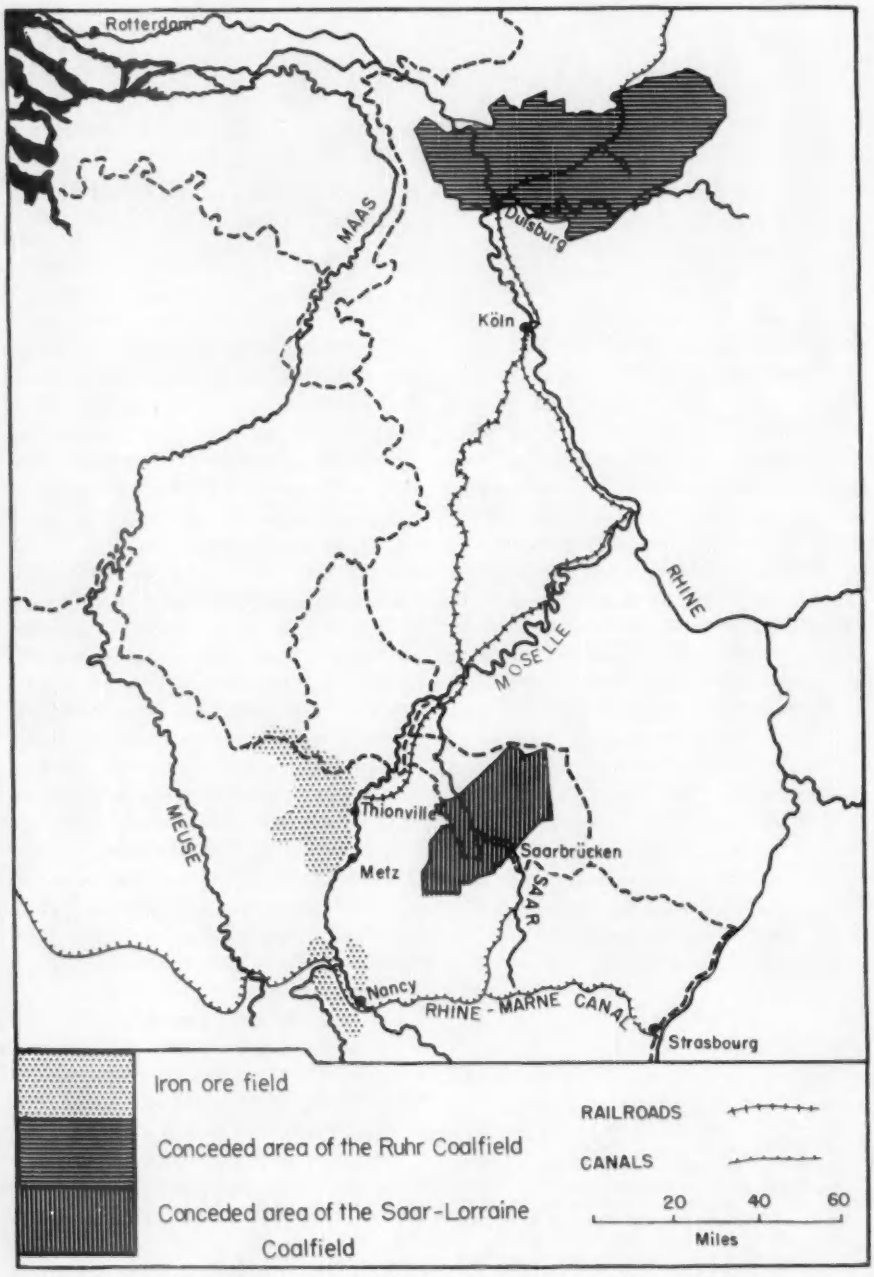


FIG. 1. Coal and iron ore in the Rhineland, Lorraine, Luxemburg, and the Saar.

demand in Lorraine for fuel from the Ruhr.

The iron industry of Lorraine was older by many centuries than that of the Ruhr, and like that of the Ruhr depended at first entirely upon local resources.[2] Iron ore deposits were scattered through Lorraine and the surrounding provinces. Within the area which now comprises industrial Lorraine and Luxembourg the ore was of two distinct types. Today the more familiar is that which has earned for itself the contemptuous epithet of *minette*. It is a low-grade, phosphoric ore, occurring in a series of beds in the upper Lias. But a century ago the more important might well have been thought to be the *fer fort*, an ore belonging to a residual deposit scattered over parts of the limestone plateau of Lorraine.[3] It occurred in small, irregular patches, was mined in bell pits, and yielded a tough iron in contrast with the brittle metal obtained by refining the pig iron obtained from the minette.

In retrospect it seemed as if Bismarck's annexation of part of Lorraine in 1871 was inspired by a desire to possess all the reserves of minette then known. Hartshorne has demonstrated[4] that the political boundary adopted in the Treaty of Frankfort of 1871 accorded closely with the strategic and linguistic aspirations of the Germans. There is no reason to suppose that the minette deposits were particularly attractive to the Prussian Chancellor, but the debates in the French Chamber, then sitting at Bordeaux, on the ratification of the German treaty, make it clear that in some quarters the objective of German policy was believed to be the annexation of the Lorraine ore deposits to meet the growing needs of German industry.[5]

The minette yielded a pig iron which, from its high phosphorus content, was particularly fluid, and eminently suited to foundry work. Most of the works which used minette were at this time engaged chiefly in making castings. Refined on the hearth, the phosphoric pig could be made to yield a poor wrought iron which found an outlet amongst the nail-makers. If great care were exercised, it could be puddled, but the iron that resulted was useless for steel making and of no high value for much else. The advent of Bessemer's and then of Pierre Martin's methods of steel making had the effect of diminishing, relatively if not absolutely, the value of Lorraine ore, which had no value at all for these processes. Thus, at the time of its annexation by Germany, the minette was sinking in the esteem of the iron masters and its importance was, relatively at least, in decline.

GERMANY ANNEXES THE ORE-FIELD (1871–1880)

The Treaty of Frankfort of 1871 and the German annexation of most of the ore field opens a second period in the relations between Lorraine and the Ruhr. Only the ore deposits near Longwy and around Nancy remained

[2] G. Hottenger: *L'Ancienne Industrie du Fer en Lorraine*, Nancy, n.d.; A. Weyhmann: "Geschichte der älteren lothringischen Eisen-Industrie," *Jahrbuch der Gesellschaft für lothringische geschichte und Altertumskunde*, Vol. 17, 1905, pp. 1–210.

[3] E. Jacquot: "Mémoire sur les mines et les minières de fer de la partie occidentale du département de la Moselle," *Annales des Mines*, 4e série, Vol. 16, 1849, pp. 427–494; J. Bichelonne and P. Angot: *Le Bassin Ferrifère de Lorraine*, Nancy, 1939, p. 20 *et seq.*

[4] Richard Hartshorne: "The Franco-German Boundary of 1871," *World Politics*, Vol. 2, 1950, pp. 209–250.

[5] *Recueil des Traités, Conventions, Lois, Décrets et autres Actes relatifs à la Paix avec l'Allémagne*, Paris, *Imprimerie Nationale*, 1872; the text of the debate on this issue is on pages 93–137; Jules Favre, *Gouvernement de la Défense Nationale*, Paris, 1871–75, Vol. 3, p. 372.

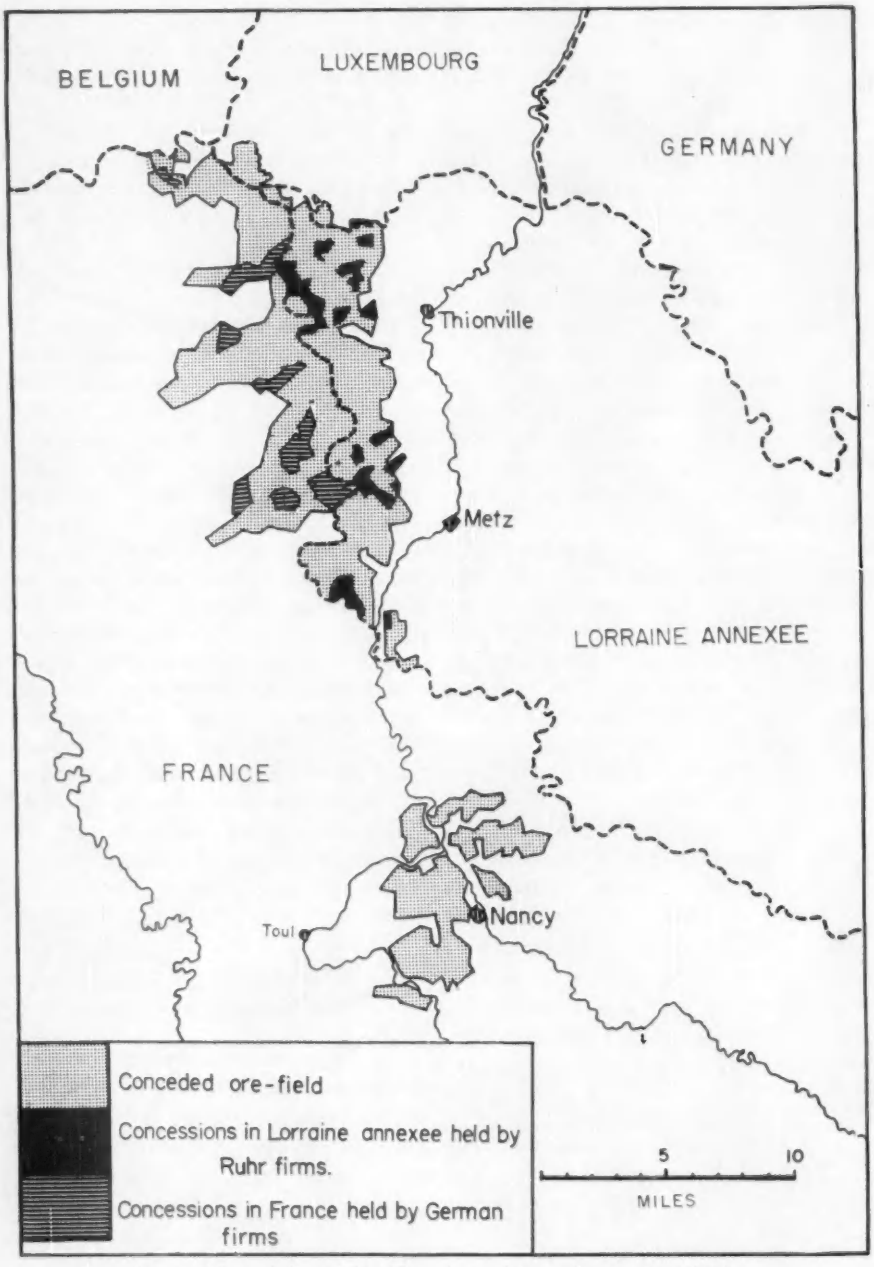


FIG. 2. Conceded ore field of Lorraine and Luxembourg, about 1910.

in French hands.[6] The Briey basin, which continued westward into France, had not yet been discovered, and its development was to wait for over 20 years. Germany took about 80 per cent of the conceded ore field of Lorraine and about 75 per cent of its small pig-iron producing capacity. At the same time, Luxembourg was in customs union with the German Empire, and German industry had unrestricted access to almost the whole minette field.

For a decade the German industrialists made no attempt to weld Lorraine and the Ruhr into a single economic unit. The Ruhr manifested no desire for the low-grade minette; the fuel required in the minette field was in fact largely supplied from the Saar, Belgium, and Northern France, with only a small contribution from the Ruhr, and much of this period was one of economic stringency, when falling prices offered little inducement to expansion or experiment.

If a close commercial link existed at this time between Lorraine and any other industrial area, it was in fact with the Saar basin. This was the nearest source of coal to the minette field and, though its coke was soft and friable, it could be used in small furnaces. De Wendel, who operated iron works in Lorraine, went so far as to build blast furnaces at Stiring, close to Saarbrücken, which he supplied with coal from the Saar and ore from his ore fields in Lorraine. For a few years de Wendel operated a shuttle service between Lorraine and the Saar, coal moving in one direction and iron ore in the other.

Coal and iron ore moved between the Saar and Lorraine also by barges on the rivers Saar and Moselle. Thionville and Metz grew to be important river ports, and after 1866 the *Canal des Houillères* and the Rhine-Marne Canal also joined in carrying fuel and ore between the Saar coal fields and the Lorraine iron ore field.

But there was no similar development between Lorraine and the Ruhr area. The minutes of the evidence furnished to the *Reichs Kommission*, appointed in 1878, to inquire into the German iron industry,[7] suggest that except for a small consumption in Lorraine of Ruhr coal, the two industrial regions were economically poles apart.

THE COMING OF THE BASIC PROCESS (1880–1890)

The year after the German Government's inquiry saw the patenting of the Gilchrist-Thomas, or basic process, for the manufacture of steel. It had come at an opportune moment for Germany. There was by now some anxiety among German iron masters for the future of their ore supply. The coal measures ore was nearing exhaustion, and the high grade ores of Spain, Elba and central Sweden were available only in small quantities. But the effect of the Gilchrist-Thomas invention was to give a new value and importance to those highly phosphoric ores which had proved unsuitable for the Bessemer process. Germany was rich in phosphoric ores, both in Lorraine and in many parts of the Northern Plain, and the new invention was eagerly adopted.

In 1879 two Ruhr concerns simultaneously blew their first basic charges, and in 1881 the first charge was blown on French soil at the Mont Saint-Martin works, near Longwy.[8] There is

[6] "Influence de la Cession de l'Alsace-Lorraine à l'Allemagne sur l'Industrie métallurgique," *Revue Universelle des Mines*, Vol. 29, 1871 pp. 241–250.

[7] *Protokolle über die Vernehmungen der Sachferständigen durch die Eisen-Enquete-Kommission*, 1878.

[8] Donald C. McKay: "The Pre-War Development of Briey Iron Ores," in *Essays in the History of Modern Europe*, edited by D. C. McKay, New York, 1936, pp. 168–184.

reason to suppose that the West German iron masters thought at first in terms of using the bedded phosphoric ores of Lower Saxony, but these were soon supplemented or replaced by ore from Lorraine. For a short period, beginning in the 1880's, the minette ore field not only supplied considerable quantities of ore to the Ruhr but constituted its largest single source of supply. At the same time Ruhr coal began to assume a relatively large role in the Lorraine smelting industry. The Saar coal was proving, as had been suggested in the minutes of evidence of the 1878 commission, unsuitable for large furnaces, and Ruhr coal and coke were in increasing demand.

Of the three practicable routes between Lorraine and the Ruhr none recommended itself as particularly convenient. The rivers Moselle and Rhine provided jointly a water route of about 290 miles from Thionville to Ruhrort. The Rhine from Koblenz to the destination presented no difficulties but the Moselle itself was shallow and meandering and unsuitable for any except small boats of slight draft. It was in fact used very little for barge traffic. The alternative water route was by the Rhine-Marne Canal to Strasbourg and thence by the Rhine to Ruhrort, a distance of about 450 miles. This route was used more than the Moselle, but it necessitated a break of bulk at Strasbourg.

The third mode of transportation was by rail—either the Moselle valley line or the route across the Eifel. Both were used, though the former became the more important. It would seem logical for the same freight cars to carry ore in one direction and coal or coke in the other. This indeed happened, but, if one may judge from the complaints in the trade periodicals, the system did not work as smoothly and as efficiently as might have been supposed. So much time was wasted switching the cars from the blast furnaces where they had discharged their ore to the mines where they were to load with coal, that it was more economical to send them back empty to Lorraine and use other cars for the coke. With the introduction of cars with high steel mesh sides for the coke, this incipient shuttle service came to an end.

Because of the political division of the ore field and the fact that much of the movement was within the German Empire, it is not easy to form an estimate of the volume of the exchange of ore and coal. It would perhaps be not incorrect to suggest that the Ruhr supplied at least half of the total fuel demand of the minette field as a whole, and was itself supplied from this source with no more than twenty per cent of its ore. The direct interchange of fuel and ore between the Ruhr and Lorraine never achieved a greater importance than it possessed in the late '80's and early '90's of the last century.

GROWTH OF INDUSTRY IN LORRAINE

A fourth period in the history of the development of relations between Lorraine and the Ruhr occupies the last decade of the 19th Century and the years leading up to the First World War.[9] It was characterized by yet another change in their relationship. Technical improvements in the design and operation of blast furnaces were reducing the consumption of fuel, and the point was reached at which to obtain one ton of pig iron at Ruhrort from minette necessitated a transport of, at a rough computation, 645 ton-miles, whereas to obtain the same amount of pig iron in Lorraine necessitated a transport of only about 200 ton-miles. It should be

[9] E. Gréau: *Le Fer en Lorraine*, Chambre de Commerce de Neurthe-et-Moselle, Nancy, 1908; A. Somme: *La Lorraine Métallurgique*, Paris, 1930.

added, however, that the distribution of iron products from Lorraine was more costly than from the Ruhr.

Under these circumstances the German concerns acquired ore concessions in Lorraine and built blast furnaces as close as was practicable to the ore. Their smelting operations were confined to Luxembourg and German-occupied Lorraine, but they took ore concessions in the part of Lorraine which remained French after 1871.[10] The Gelsenkirchen concern, after merging with the owners of smelting works at Esch and at Audun-le-Tiche, built in 1909 a large new works at Belval, close to the ore field. Deutsch-Luxemburg, which was controlled by Stinnes, established the Differdange furnaces, and Thyssen those at Hagondange. Gütehoffnungshütte of Oberhausen, and Phönix of Ruhrort prepared plans for the erection of smelting works on the minette field, but were anticipated by the war of 1914. Rumor credited Krupp of Essen with a similar intention.

Three out of the five major works in the Saar also built or acquired blast furnaces in Lorraine: Stumm at Uckange; Roechling at Thionville and Dillingen at Redange. Furthermore, the Saar works of Burbach and Saint-Ingbert were part, respectively, of the Luxembourg concerns of Arbed and Hadir. Most of the other leading iron and steel concerns of northwest Germany—Krupp, Rheinstahl, Hoesch, Klöckner, Hoerde, Bochum, and Dortmund—acquired ore concessions on which, if the war of 1914 had not occurred, some of them would certainly have erected smelting works.

[10] Louis Bruneau: *L'Allemagne en France*, Paris, 1915, pp. 32–120; L'Alsace-Lorraine et la Frontière du Nord-Est, *Travaux du Comité d'Etudes*, Paris, *Imprimerie nationale*, 1918; M. Ungeheuer: Die industriellen Interessen Deutschlands in Frankreich vor Ausbruch des Krieges, *Technik und Wirtschaft*, Vol. 9, 1916, *passim*.

The practice of heat economy made it desirable to establish steel and rolling works in the closest possible proximity to the blast furnaces. Only a very few works in Lorraine, whether French or German, remained without steel works, and these specialized in iron castings. It became the function of most of the steel works in German Lorraine and in Luxembourg to produce "semis" or half-finished goods for further fabrication in the machine shops of Germany.

The same pattern of relationships was developed, though it is irrelevant to the question in hand, by the iron and steel companies of Belgium and the rest of France. Their works located on the ore field were used to supply pig iron or crude steel to their fabricating and engineering works in Fourchambault and Liége, in Commentry and Montluçon, in Aubrives and Maubeuge.

The map, Figure 3, illustrates the links that were thus established between steel-making and steel-using concerns of other parts of Western Europe on the one hand and the ore mines and ironworks in Lorraine and Lusembourg on the other. Only such *liaisons* as were publicly announced can be represented in this way. There were other bonds with works in the minette region, such as sales agreements and holdings of stock which amounted to something less than complete control over mines and ironworks. These also, in varying degrees, assured to steel and engineering works a supply of pig iron and steel and secured to the works located on the ore-field a market for their pig iron and "semis."

The minette region, taken as a whole, was one of the greatest suppliers of pig iron and crude steel to the countries of Western Europe. On the eve of the First World War its combined pig iron output exceeded that of the Ruhr by

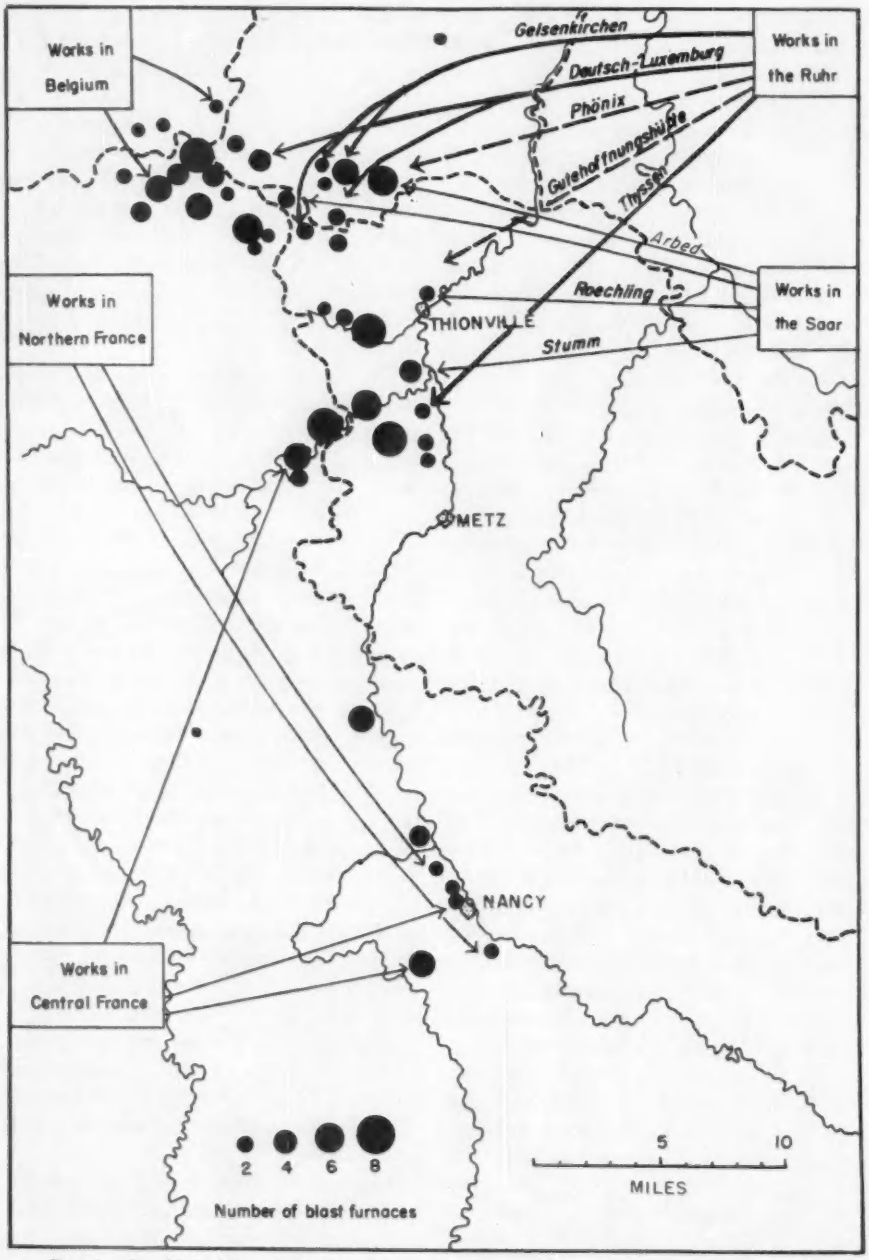


FIG. 3. Outside holdings in the iron and steel industry of the minette region, about 1910.

more than a million tons, and its steel production was two-thirds that of the Ruhr. If the biggest market for its pig iron and steel ingots, strip, and sheet was in the mills and workshops of the Ruhr, its sales to Aachen, Cologne, and the Saar, to south and Central France, and to Belgium were also large and important.

It is not easy to demonstrate the extent of the dependence of the minette area as a whole on the coal of the Ruhr. There can be little question that during these years of rapidly increasing steel production there had not been a proportionate increase in coke-oven capacity and there was a real shortage of coke. Most of the German concerns which had acquired blast furnaces and steel works in Lorraine had also bought up coal mines in the Ruhr. Their coke supply was assured, and we may assume that the coke was taken direct from the companies' coke ovens in the Ruhr to their furnaces in Lorraine or Luxembourg. The independent iron and steel works of Aumetz–Friede, at Knutange, and of de Wendel at Hayange and Moyeuvre in German Lorraine and at Jœuf in France, each bought coal mines in the Ruhr. Other Lorraine concerns entered into partnerships or agreements with Ruhr coal interests, such as the *Gelsenkirchener Bergwerks A. G.*, but there can be no doubt that the iron-works which did not actually possess their own coal mines in the Ruhr basin experienced great difficulty in obtaining enough metallurgical coke.[11]

As almost all the coal mining industry in the Saar was in the hands of the Prussian State, the Saar industrialists, Stumm and Roechling, had also bought coal mines in the Ruhr, which were used to supply their Lorraine furnaces.

The position in French Lorraine, however, was less satisfactory. Coking coal was obtainable in quantity only from the coal field of Northern France, and the supply from this source was quite inadequate for the needs of the French smelting industry.[12] The blast furnaces of French Lorraine—at Longwy, Homécourt, Jœuf, and Nancy—obtained their fuel where they could. The attempts of the French iron companies of Lorraine to secure control of a source of fuel make an interesting chapter in the history of the French metallurgical industry. The Ruhr coal was the most satisfactory from the metallurgical point of view and, on balance, the cheapest, but the German Coal Syndicate was generally unwilling or unable to supply the quantities asked by the French and was accused of deliberately starving them in the interests of their German rivals. France imported about half the coke needed for metallurgical purposes, and of this, during the years before the First World War, France took about a half from the Ruhr.

Thus the iron works of the minette area as a whole were dependent upon the Ruhr for the supply of fuel to the extent of about 70 per cent. The rest was obtained from Belgium and Northern France.

West Germany, in the meanwhile, had almost emancipated itself from direct dependence upon Lorraine ore. This was made possible partly by a heavy consumption of pig iron, ingot steel, and other half-finished goods from the minette area; partly by the substitution of Swedish ore for that from Lor-

[11] G. Villain: *Le Fer, la Houille et la Métallurgie à la fin du XIX^e Siecle*, Paris, 1901, pp. 61–67; *Rapport Général sur l'Industrie française, sa situation, son avenir*, Paris, *Imprimerie Nationale*, 1919, p. 1re partie, tome I, p. 14, where the German coal cartel is charged with discriminating against France in the sales of metallurgical coke.

[12] Auguste Pawlowski: *Le Dévelappement minier et métallurgique et les Problèmes qui s'y rattachent dans l'Est français, le Luxembourg, l'Alsace-Lorraine et la Belgique*, Paris, 1913.

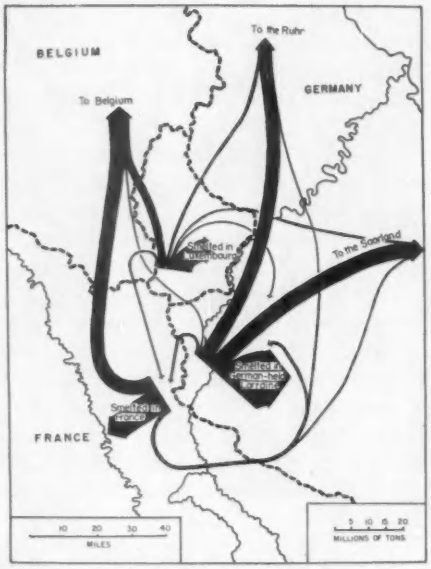


FIG. 4 (left). Movement of iron ore from the minette region of Lorraine and Luxembourg, in 1910. The use of the very small production of minette in southern Belgium is not shown.

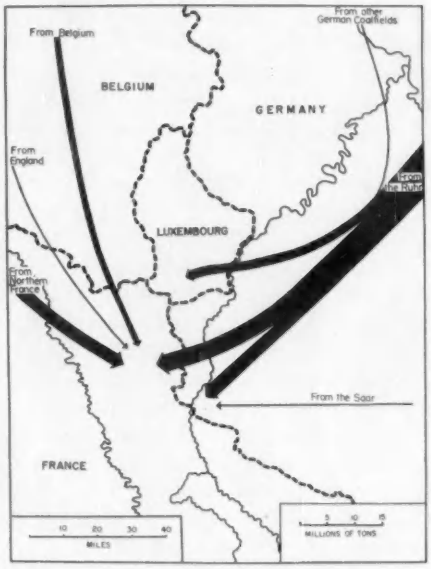


FIG. 5 (right). Movement of coal and coke (not distinguished) to the minette region of Lorraine and Luxembourg, 1910.

raine. The great ore deposits of Swedish Lappland had been opened up in the closing years of the 19th Century. The railway from the mines to the Baltic coast had been completed in 1888, and that to Narvik in 1902. Suitable docks already existed at Ruhrort; the Dortmund–Ems Canal was opened to traffic in 1898, and the intermediate Herne Canal was begun in 1906. As a result, Swedish ore could be delivered in the central Ruhr at a price a few *pfennig* less per ton of iron content than the minette. Add to this that the richer Swedish ores permitted a richer furnace charge and a larger output of pig iron from each furnace, gave less slag, and yielded other economies of a technical order. Henceforward, Swedish ores were to dominate the iron-smelting industry of the Ruhr.

In these circumstances, the actual movement of ore from Lorraine to the Ruhr was quite small. The map (Fig. 4) illustrates the flow of minette in 1910. The greatest volume of exported ore went to Belgium, and the Saar took more than the Ruhr.

In 1917, the German Iron and Steel Manufacturers addressed a memorandum to the German Chancellor requesting that the incorporation of the *whole* minette area within the Reich should be made one of Germany's war aims.[13] This document has been taken to show that the German industrialists expected to increase their dependence on Lorraine ore and desired to strengthen their relations with Lorraine.

The industrialists certainly desired to put more territory between their works in Lorraine and the French boundary; they would have liked to

[13] *German Designs on French Lorraine*, The Secret Memorandum of the German Iron and Steel Manufacturers, English Translation, London, 1918.

extinguish French competition, but the real reason for their action lay in the recent action of the Swedish government in setting statutory limits to the volume of export of iron ore. The German technical and trade press reflected with what consternation this decision was received in Germany; the corresponding French press reveals a modest optimism that there might be increased sales of minette within Germany. In the event, however, the Swedish action did not lead to an increased consumption of minette in Germany.

THE INTER-WAR YEARS (1919–1939)

A fifth period begins with the end of the First World War, the return of German Lorraine to France, and the separation of Luxembourg from her customs union with Germany. German holdings in the minette deposits and in the iron and steel works of Lorraine and Luxembourg were expropriated and re-established as French and Belgian companies. The degree of interdependence which had existed between German Lorraine and the Ruhr was further reduced. In 1922, only 6 per cent of the pig iron produced in Germany was from minette. This proportion changed very little; in 1928 it was still about 6 per cent. It rose to at most 8 per cent, but for the years 1937 to 1940 was 1 per cent or less. Under the abnormal conditions of the Second World War, the German consumption of minette was higher because this ore could be transported with less danger and without calling upon Germany's naval resources. This unaccustomed use of minette instead of Swedish ore in the Ruhr furnaces during the war led to such an acute problem in handling the excess of blast furnace slag that, at the Friedrich-Alfred Hütte, one furnace had to be closed down.[14]

It is more difficult to evaluate the amount and source of coal and coke deliveries to the iron industry of Lorraine.[15] In 1937, coke imports into France were 3,141,000 tons, of which 2,351,000 came from Germany. The total consumption of the French smelting industry was 8,461,000 tons. If we make allowance for the use of German coal in the few coke ovens of Lorraine,[16] the French industry cannot have derived more than about 35 per cent of its fuel from Germany.[17] The position in Luxembourg is easier to evaluate: 80 per cent of its fuel was from the Ruhr; most of the remainder from Belgium.

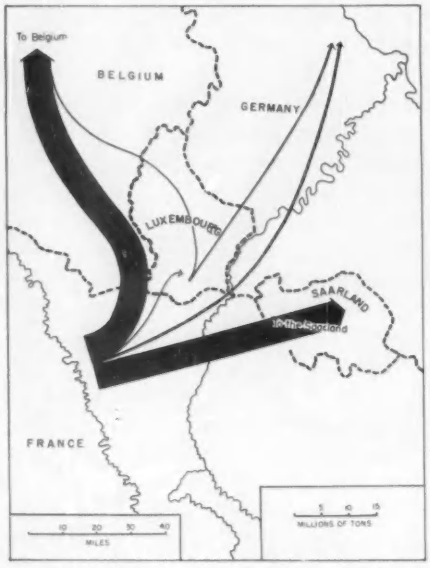
The maps, Figures 6 and 7, show the movement of coal, coke, and iron ore between France and Germany in 1937. It can be seen that the movement of iron ore from the minette region to Germany was directed in large measure to the Saar. The iron furnaces here had been organized, for a very long time before France acquired a political ascendancy over this area, to use only minette.

[14] *Friedrich-Alfred-Hütte at Rheinhausen*, C.I.O.S., Vol. 24, p. 10.

[15] Alfred H. Brooks and Morris F. La Croix: *The Iron and Associated Industries of Lorraine, the Sarre District, Luxembourg and Belgium*, Bulletin 703, U.S. Geological Survey, Washington, 1920, p. 26, suggests that the predominance of Ruhr coal in the Lorraine industry was due to German political control over much of the area. This conclusion is not borne out by subsequent developments. The inadequacy of French coke production is stressed in R. Jordan, The French Iron and Steel Industry, *London and Cambridge Economic Service*, Special Memorandum 20, 1926, 4 *et seq.* Raoul du Fou: *Le Movement de Concentration dans la Sidérurgie Lorraine*, Paris, 1934.

[16] Consommation et Production de Coke en Meurthe-et-Moselle, *Annales de Geographie*, Vol. 39, 1930, p. 333.

[17] Finance-Minister Dietrich, in evidence before the Nürnberg Military Tribunal, claimed that it was his policy to "give the French an interest in the Ruhr coal, and vice versa, give the Ruhr an interest in the French Minette"; *Trials of War Criminals*, VI, *The Flick Case*, Washington, 1952, p. 224.



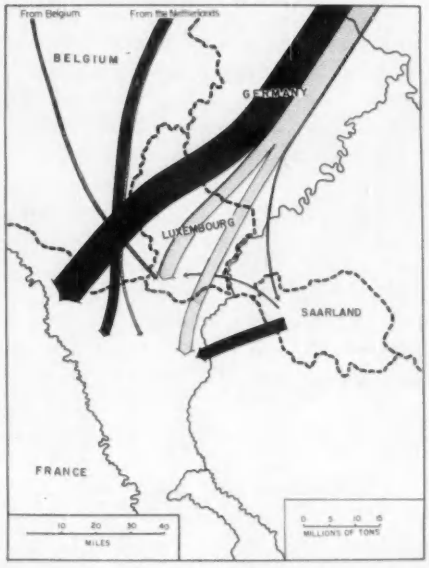


FIG. 6 (left). Movement of iron ore from the minette region of Lorraine and Luxembourg, 1937.

FIG. 7 (right). Movement of coal and coke to the minette region of Lorraine and Luxembourg, 1937. Belgian exports to France (3,396,000 tons of coal and 620,000 tons of coke were almost certainly destined for other parts of France and are not shown on this map).

THE POST-WAR PERIOD

The trading pattern, lastly, that has emerged since the end of the Second World War is in its essentials very similar to that which existed between the two wars. German purchases of ore from Sweden have been considerably reduced, but this has been more than offset by the very marked increase in the production of domestic ore, especially the low-grade, phosphoric ores from Peine and Salzgitter in Lower Saxony. Imports from France have been reduced even below the low level of the inter-war years, and it is doubtful whether in 1951 much more than 1 per cent of the German pig iron has been actually smelted from Lorraine ore.

At the same time the dependence of Lorraine on coke and coking coal from the Ruhr remains considerable, and it is difficult to see how this liability can be greatly diminished. In 1951, about half the coke required was imported, and two-thirds of this came from the Ruhr. Again the iron smelting firms of Lorraine are complaining that coal deliveries from Germany are both inadequate in quantity and poor in quality. The report for 1951 on *La Région économique de l'Est* complained that the area had been able to get from Germany only 770,000 tons a month out of a million tons required, and that in consequence the smelting industry operated at only 80 per cent of its capacity.[18] There has been no radical change in the situation since this date, though a group of French iron and steel firms have recently combined to purchase a group of coal-mines in the Ruhr in order to improve their fuel situation.[19]

[18] Situation de l'Economie Régionale en 1951, *Bulletin périodique de la Région économique de l'Est*, 1952, p. 49.

[19] Steel Developments in France, *Monthly Statistical Bulletin, British Iron and Steel Federation*, Vol. 30, No. 8, August, 1955.

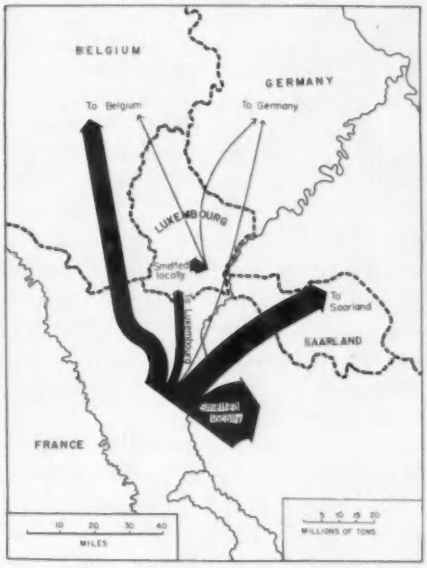


FIG. 8 (left). Movement of iron ore from the minette region of Lorraine and Luxembourg in 1950.

FIG. 9 (right). Movement of coal and coke to the minette region of Lorraine and Luxembourg, 1950. Coal is shown in black, coke by stipple shading.

CONCLUSION

Two questions remain, one technical, the other political and economic. What would be the effect on the trade in iron ore if the Moselle were made navigable? This proposition was canvassed very actively in Germany in the 1880's and 90's, that is, before Swedish ore had come to be used on a large scale and when there was every prospect of an increasing German dependence on the minette.[20] But thereafter Ruhr interests tended in general to oppose a step that would result in cheapening fuel and thus pig iron in the Lorraine. It remains true today that the canalization of the Moselle would be likely to benefit Lorraine rather than the Ruhr. At the moment there is an active movement in its favor in Metz, and it seems that German opposition to the project is weakening.

The second question concerns the possible consequences of the creation of a common market for coal, iron, and steel. It has been suggested in the press that a more vigorous exchange of Ruhr coal for Lorraine ore might result. But this view fails to take account of the fact that the operation of a smelting works is normally geared to a specific type of ore or mixture of ores. Any change in the furnace charge would be likely to disorganize all subsequent stages. It is by no means clear yet that the operation of the Common Market would make minette cheaper in the German market relative to Swedish ore.

[20] There is a very extensive literature from the period before 1914 on the canalization of the Moselle, especially Hermann Schumacher, *Die westdeutsche Eisenindustrie und die Moselkanalisierung*, 2 vols., Leipzig, 1910. Recent surveys of the problem are: J. Levainville: "La Canalisation de la Moselle," *Annales de Geographie*, Vol. 37, 1928, pp. 180–184; "Die Kanalisierung der Mosel von Metz bis Diedenhofen und ihre wirtschaftliche Bedeutung," *Stahl und Eisen*, Vol. 52, No. 2, 1932, pp. 963–964.

The dis-economies of a technological order that would attend such a change from Swedish to Lorraine ore makes such a transition highly improbable. The most that can be expected is that minette may perhaps replace the low-grade, phosphoric ore which some of the German smelting works now obtain from mines in Lower Saxony. But, at present, transport costs do not favor such a change.

The operation of the Common Market on the fuel supply to the Lorraine smelting industry is quite different. Ruhr coal and coke are in great demand, and the difficulty has been that the French have had to compete for it in the German market with the German consumers. There can be no question that this has deliberately been made difficult for the French. The removal of German discriminatory practices, including the breakup of the new coal cartel and the termination of discriminatory freight rates, cannot do other than make the Ruhr fuel more easily accessible to the Lorraine industrialist.

The possibility of the greater use of Saar coal and of coal from the continuation into Lorraine of the Saar field cannot be excluded. Experiments in blending and coking the coal from this field have met with considerable success, though the processes remain complex and costly. At present Ruhr coke is preferred on both technical and economic grounds.

To summarize: During the period of 80 or 90 years, during which there has been an exchange of raw materials between the Ruhr and Lorraine-Luxembourg, there have been considerable fluctuations in the dependence of each on the other. In general the minette region has derived from a half to two-thirds of its fuel supply from the Ruhr, and would certainly have taken more had it been able. The dependence of the Ruhr on minette has never amounted to more than 20 per cent of its total need, and for over half a century has been a great deal less. During the whole period it has probably not averaged much more than 10 per cent.[21]

The importance of political factors in keeping this degree of interdependence as low as it has been must not be exaggerated. They were probably of some significance between the wars, but the trends which were manifest then had actually appeared before 1914; namely, the increasing dependence of Germany on Swedish ore and the rise of a large smelting capacity on the minette field. More important than the political, however, have been the technological factors: the improving ratio of coke to ore, the better design of the furnaces, and the adjustment of steel and rolling mills to the output of the furnace. A pattern in these respects had been formed early in the present century and it has since changed very little.

[21] See W. Parker in N. J. G. Pounds and W. Parker, *Coal and Steel in Western Europe* (London).

THE RETAIL POTENTIAL OF SOME REPRESENTATIVE NEW ZEALAND TOWNS*

L. L. Pownall

Dr. Pownall is Senior Lecturer in Geography, Canterbury University College, Christchurch, New Zealand. This paper is one of several which he has published on the results of his research on the contemporary New Zealand town.

EVERY nucleated settlement is the local center of a rural area which looks to it for some or all of the goods and services which alone are provided by central places.

The boundaries of these areas may be determined with reasonable accuracy from interviews with business people and administrators in each town. An area so defined is strictly a trade region, a region from which people come to transact business in a specific town. To such an area the name "tributary region" has been customarily and usefully applied in New Zealand.[1]

Because the larger centers offer the wider range of services they therefore serve the most extensive rural areas and encompass within their regional boundaries the trade areas of smaller towns. The tributary regions of these lesser centers in turn are made up of the trade areas of "sub"-urban settlements.

The boundaries between the tributary regions of towns of equal rank in New Zealand are relatively well defined and only in a few cases, such as Wanganui and Palmerston North, is there an extensive overlap in the areas claimed by two centers (Figs. 1 and 2).[2] It is much more common to find that tributary regions—where they do not fit together neatly—are separated from one another by a zone of sparse rural settlement which is unclaimed.

The urban geographer is by no means the only investigator with an interest in regional and town relations. The trade relations of urban centers are also of considerable interest to the businessman. However, unlike the situation in the United States, where the study of market boundaries has reached a relatively advanced stage, very little has been done in this field in New Zealand either academically or commercially. The methods employed by some firms in New Zealand to obtain an approximate measure of the commercial prospects of a specific town have sometimes been so broad as to produce results of low reliability, such as using as a guide the number of householders in a rural district served by a regional post office.[3] Such investigations, however crude, are a recognition by business people of the

*The extensive field work upon which this study is based was made possible by a grant from the Research Grants Committee of the University of New Zealand to whom grateful acknowledgment is made.

[1] See, for example, J. U. Macaulay: "The Oamaru Tributary Region," *New Zealand Geographer*, Vol. 10, No. 2, 1954, pp. 121–133.

[2] The boundaries of tributary regions were defined for this study by asking executives of banks, department stores, stock firms, clothing and footwear shops, and lawyers in each town to define on a large scale map, independently of one another, the extent of the region from which they believed the majority of customers came to that town. The majority of these boundaries coincided. These regional boundaries were then checked against the regional limits claimed by competing towns.

[3] New Zealand Post and Telegraph Department: *Lists of Householders in Postal Districts*, (duplicated), Wellington n.d. (irregular publication).

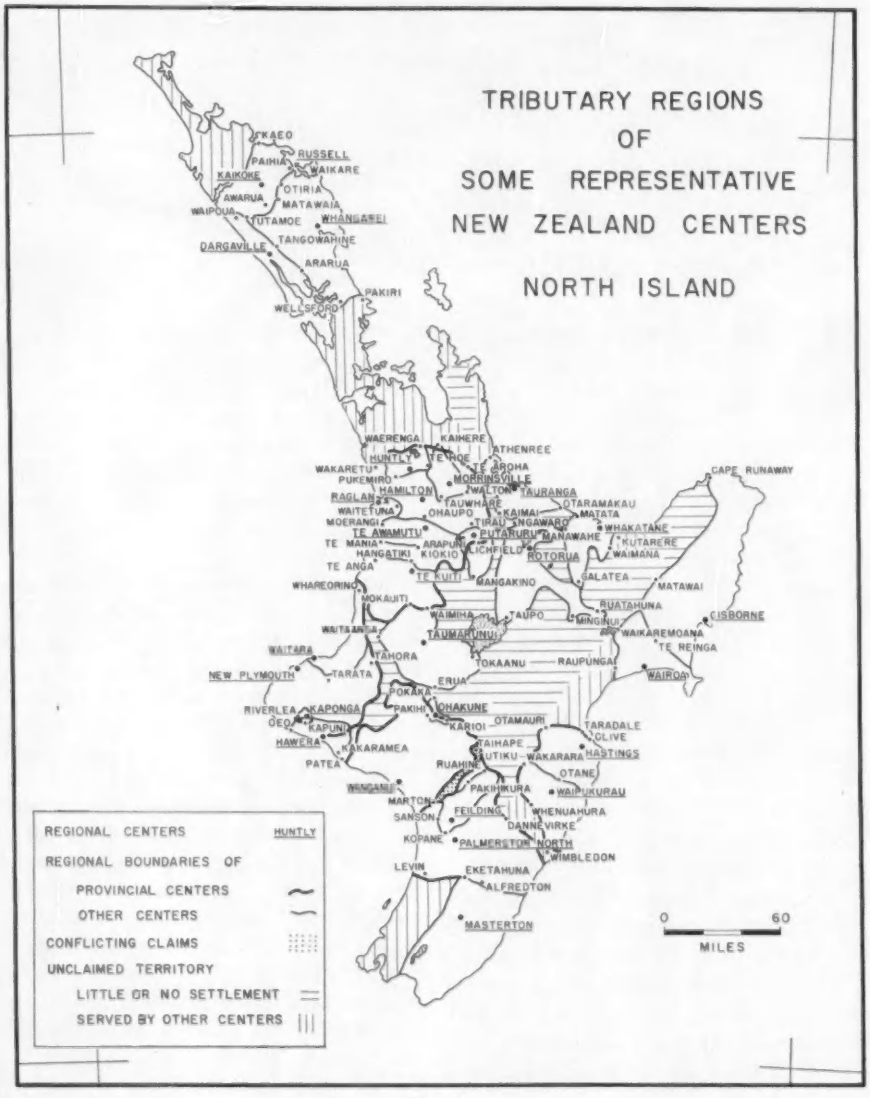


FIG. 1.

fundamental differences that exist in the urban and rural ratio from center to center, for not all urban areas of similar size have the same numbers of people living in their tributary regions.

At best the ratio between town and dependent rural population is a crude measure of the commercial potential of a town since it takes no account of the number of workers already employed in commerce, or in a specific branch of commerce. While an urban center may have a high urban rural ratio it may at the same time offer little opportunity for

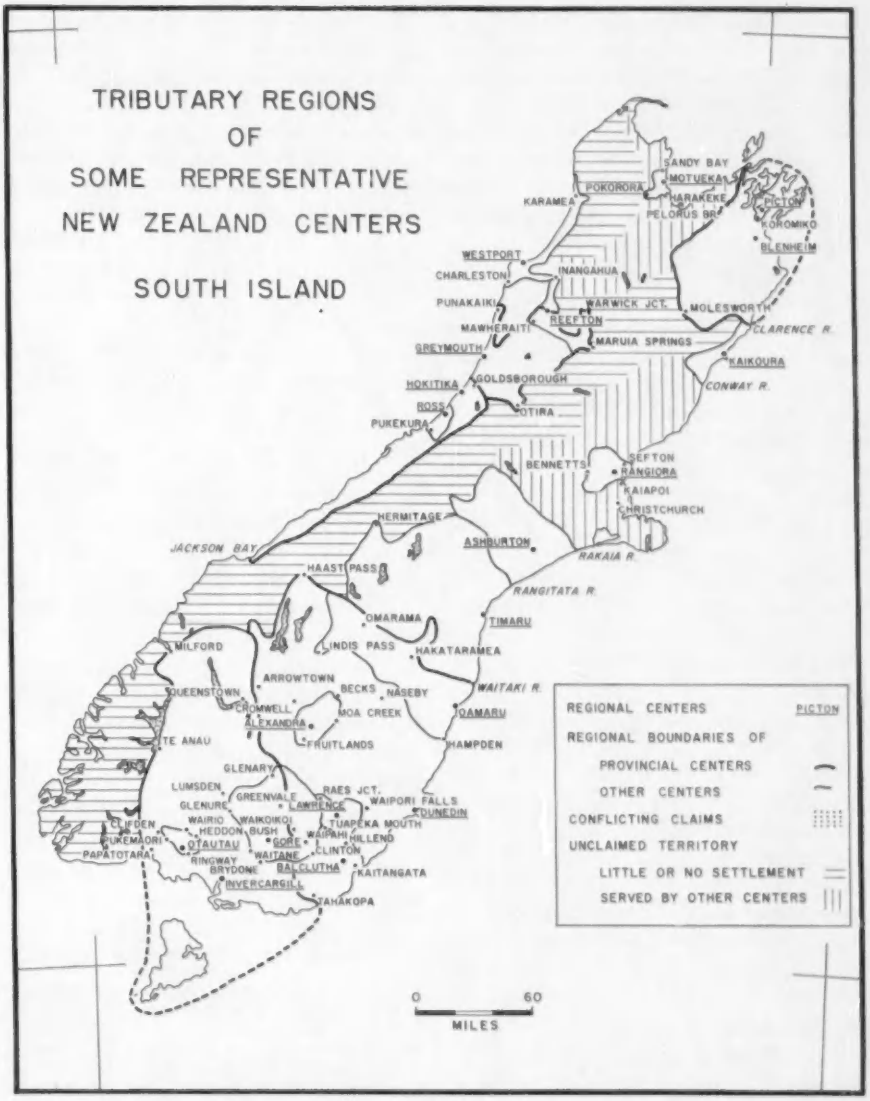


FIG. 2.

commercial expansion because it already has an exceptionally large number of employees in distribution and finance.

A SUGGESTED INDEX

A more realistic measure of retail potential seems possible. Such a measure should show the capacity of a town to increase its number of workers in commerce (or in any one specialized branch of commerce). It should also make possible comparisons between towns on the basis of *present* demand for commercial services, since the assess-

ment of future population capacity in a rural area is a matter only of conjecture.

In seeking a method of measurement it may be assumed at the outset that if one commercial worker in the trade area of a town can obtain a living from serving, say, 30 people, another region (tributary to a town of comparable size) with one commercial employee serving 60 people could theoretically double its commercial labor force. The latter region may be said to have a potential capacity for expansion of 100 per cent.

If these are valid assumptions the problem of measuring the approximate retail potential of a town is reduced to six steps. First, calculate (from census population mesh sheets) the total urban and rural population in the tributary region of each town. Second, calculate the number of workers in distribution and financial services for the same regions.[4] Third, calculate the ratio between commercial workers and dependent population for each region. Fourth, group together towns of comparable size. Fifth, select the lowest ratio between commercial workers and dependent population of all towns of comparable size and use this as the basis for calculating potential increases in other centers. And, sixth, calculate the potential increase per cent in all other centers, the town whose ratio is lowest having no existing potential. An example will serve to clarify this description.

In 1951 there were 79,474 people in the urban area and tributary region of Invercargill. They were served by 3669 workers in distribution and finance, giving a ratio of one worker in commerce to every 21.7 people in the whole region. This was the lowest ratio of all towns of 19,000 to 34,000 population. The tributary region and town of Gisborne, by comparison, had 1308 commercial workers serving 38,405 people, that is a ratio of 1 : 29.3. At the same ratio as that existing in Invercargill there would have been 1769 commercial workers in the Gisborne area, instead of only 1308. The commercial labor force in Gisborne (or in its smaller dependent centers) could have been increased by 460 workers, or by 35.1 per cent over the existing number. This percentage may be called the "Index of Potential in Distribution and Finance," or the IPDF.

[4] In New Zealand this information is collected in April and October of each year by the Department of Labour and Employment.

Regional Variations

The calculation of similar indices for other centers provides a graded measure of commercial potential among New Zealand towns at that time (Table I). But the geographer is not merely interested in the measurement of potential for individual towns; he is equally concerned with recognizing and analyzing similarities in commercial potential among towns in the same parts of New Zealand. When these indices are mapped, differences among geographic regions become apparent (Fig. 3). These regional variations call for brief comment.[5]

The most uniformly promising zone of commercial development by this

[5] In many parts of New Zealand only a limited number of towns have been sampled so that the following conclusions are often of the most general character. At the same time it should be appreciated that the urban areas sampled generally include the greater proportion of urban population in a district, except for those districts which include one of the four metropolitan centers. These four cities have been purposely excluded from the survey because of problems in the definition of their tributary regions, which could not be delimited with the same criteria used for other towns. Even a marked variation in the indices of the smaller towns which were not sampled would not seriously affect the general tendency revealed by the survey. However, the reliability of the data in terms of the number of urban samples taken in an area should still be kept in mind.

TABLE I

INDEX OF POTENTIAL IN DISTRIBUTION AND FINANCE FOR SOME REPRESENTATIVE NEW ZEALAND TOWNS, 1951

(1000–34,000 population)

Size	*Town*	*Commercial workers: total population*	*Potential increase numbers*	*Increase per cent*
19,000–34,000	Invercargill	1 : 21.7	0	0
	Gisborne	29.3	460	35.1
	New Plymouth	29.3	932	35.0
	Hastings	27.4	435	26.3
	Palmerston North	27.2	845	25.2
	Hamilton	26.3	1052	21.1
	Wanganui	24.7	307	13.8
	Timaru	22.0	26	12.1
	Average	25.9	....	....
9000–12,000	Oamaru	23.0	0	0
	Rotorua	42.3	472	83.9
	Whangarei	32.0	483	38.7
	Masterton	26.7	176	16.2
	Greymouth	25.3	99	9.9
	Ashburton	23.3	9	1.1
	Average	28.6	....	....
5000–8000	Hawera	23.8	0	0
	Westport	34.2	133	43.7
	Tauranga	32.0	291	38.8
	Feilding	31.3	114	31.6
	Gore	25.6	39	7.6
	Blenheim	24.0	35	4.4
	Average	28.7	....	....
3000–4000	Hokitika	36.8	0	0
	Whakatane	63.5	158	72.5
	Huntly	59.3	101	61.2
	Te Kuiti	53.0	97	44.0
	Wairoa	43.2	42	17.3
	Te Awamutu	42.5	47	15.4
	Taumarunui	41.9	47	13.9
	Average	48.6	....	....
2000–3000	Dargaville	40.9	0	0
	Balclutha	75.5	115	84.5
	Waitara	74.8	72	81.8
	Morrinsville	51.2	63	25.0
	Waipukurau	43.0	13	5.1
	Motueka	43.0	18	5.0
	Rangiora	42.8	9	4.5
	Average	53.0	....	....
1000–2000	Kaikoura	25.9	0	0
	Kaikohe	108.1	372	318.0
	Putaruru	90.9	303	250.4
	Alexandra	86.9	108	234.8
	Ohakune	67.3	75	159.5
	Picton	42.3	42	62.7
	Reefton	42.1	46	62.1
	Average	66.2	....	....

Source: 1951 Census and Half-Yearly Survey of Employment, 1951.

measure extends across the northern fringe of the North Island Central Plateau from Te Kuiti to Whakatane (Fig. 3). Only one other district is of comparable commercial potential, and this is far smaller in area and in number of towns. Each of the four towns on the Volcanic Fringe has its pioneering zone of unique character ranging from pastoralism, coal mining, and indigenous timber milling in the west, to dairying and exotic timber working in the east.

Of comparable importance with this district is northeastern Northland.[6] In

[6] This region is mentioned after the fringe of the Volcanic Plateau only because of the incompleteness of the urban coverage in Northland, whereas in the plateau area every urban center was studied.

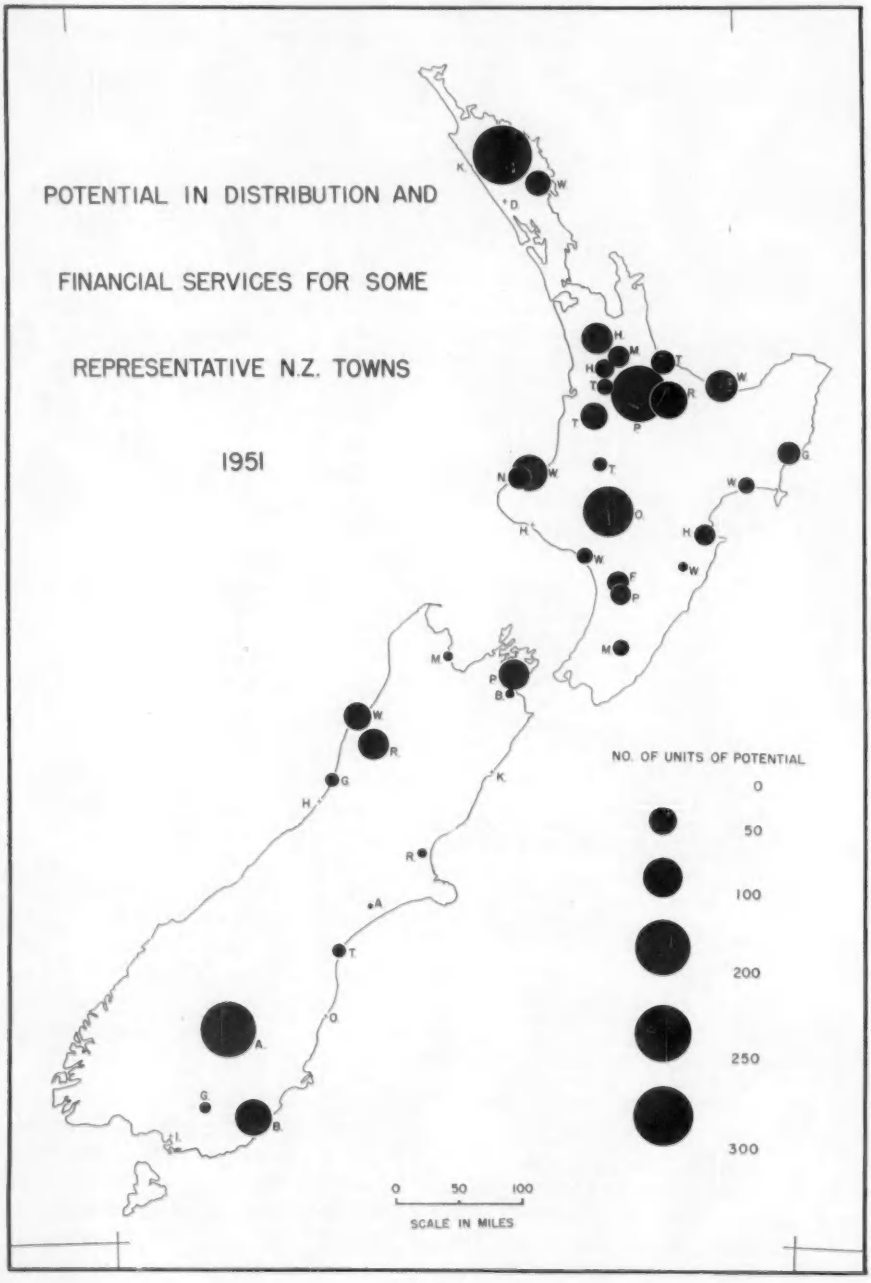

POTENTIAL IN DISTRIBUTION AND
FINANCIAL SERVICES FOR SOME
REPRESENTATIVE N.Z. TOWNS
1951
NO. OF UNITS OF POTENTIAL
0
50
100
200
250
300
0 50 100
SCALE IN MILES

FIG. 3.

this region Kaikohe has the highest individual rating of all New Zealand towns, a feature that is derived from its youthful development in a district of expanding pastoral farming, and a feature that is reflected in the buoyant optimism of this urban center. At the same time Whangarei is becoming increasingly the regional center of the whole of Northland and benefiting as a result from the growing rural settlement on these new frontiers of farming.

Somewhat surprisingly the middle and lower Clutha Valley of the South Island ranks only slightly below northeastern Northland in the commercial potential of its towns, chiefly on account of the high index of Alexandra, the center of an increasingly important region of commercial orcharding and sheep farming. This is the most promising district in the South Island in terms of urban retail potential.

These two towns are of greater uniformity in their IPDF than are the urban centers of Waikato, Piako, and northern Bay of Plenty with which they may be compared. Towns in the latter region, between Huntly and Tauranga, serve predominantly dairying and sheep farms on the broad valley floors and hillsides that comprise this part of the North Island. To an even greater extent than the urban centers of Waitara and New Plymouth they too have fringing areas of pioneer farming, while rural settlement is being intensified on their dairying land that was settled at an early period.

Next in rank in the South Island to the towns of the middle and lower Clutha Valley are Westport and Reefton. The relatively high rating of Westport is misleading, however, since it is probably derived in large part from the insecurity that is felt in that town about the future of the local coal-mining industry, an insecurity that is exhibited by the low value of urban property. In contrast to Kaikohe, Westport is pervaded by an air of pessimism which is in contradiction to its high index of retail potential.

Feilding and Palmerston North in eastern Manawatu also have satisfactory indices since rural settlement on their tributary farm lands is steadily increasing both on the Manawatu Plain and on the northeastern hills.

Apart from the districts in which an inadequate urban sample has been taken (such as the eastern coastal districts of the North Island), none of the remaining regions show significant retail potentials by this measure. This is not surprising in the case of Hawera and Wanganui where the hill-country farms and the flatter dairying country have shown relatively little growth in population over the past 20 years.[7] Nor is the low ranking of urban centers on the southwest coast and east coast of the South Island unexpected since Westland has an exploitative economy while there has been relatively little increase in population in the eastern regions during this century.

What is surprising is the inferior rating of urban centers in Eastern Southland, although an examination of regional population growth suggests the likely cause in the Invercargill region to be the relative lack of additional rural population in the face of rapidly increasing urban numbers.

CONCLUSION

In review, one of the most striking features to emerge from this survey is the difference between the retail potential of towns in the two islands. By this measure the North Island is clearly the land of commercial opportunity, on the

[7] See L. L. Pownall: "Town and Region: A Comparison of Palmerston North, Wanganui and New Plymouth," *New Zealand Geographer*, Vol. 9, No. 1, 1953, pp. 1–16.

basis of present demand. The opportunities which seem to exist today in many North Island towns are likely to remain, even after the addition of further retail and distribution units in these centers, since their tributary regions have by no means been fully settled. In this respect they are far different from the trade areas of many South Island urban centers.

The study of town and region is a rich field for further investigation in New Zealand since knowledge of their interrelationships is far from complete. The present exploratory survey shows a little of this wealth of material, much of which remains for further discovery and examination.[8]

[8] The method used in this survey is in no sense definitive and final. Even greater accuracy in the measurement of commercial potential might be obtained from some method which employs the basic/nonbasic concept of assessing urban services, in association with the method used in the present study. See in this connection John W. Alexander: "The Basic-Nonbasic Concept of Urban Economic Functions," *Econ. Geogr.*, Vol. 30, 1954, pp. 246–261; and Victor Roterus and Wesley Calef: "Notes on the Basic-Nonbasic Employment Ratio," *Econ. Geogr.*, Vol. 31, 1955, pp. 17–20.

RECOVERY OF THE SUGAR INDUSTRY IN INDONESIA

D. W. Fryer

Mr. Fryer is Senior Lecturer in Economic Geography at the University of Melbourne, Australia. He spent several months in the field in Indonesia in 1956 under the auspices of the University's Department of Indonesian Studies.

VICISSITUDE and catastrophe have been of fairly frequent occurrence in the world sugar industry, whose history has seen many remarkable fluctuations of fortune. Indonesia, successor to the Netherlands Indies, has been a sugar producer of the first importance for a considerable time, a low cost producer whose efficiency made it a strong competitor in the contracting "free" market of the inter-war period. But not even its efficiency could protect it from the Great Depression, the planted area of estate cane falling catastrophically from 200,000 hectares in 1931 to 27,600 in 1935. By 1939 the planted area had climbed again to 94,900 hectares; then in the Second World War, Indonesia, the second largest cane sugar exporter in the world, was eliminated, together with a large part of the European beet industry, and the way was open for the enormous expansion of cane sugar production in the western hemisphere, an expansion which continued in most producing countries of that part of the world until 1953. In this post-war phase of expansion Indonesia was denied a part, for what remained of the sugar industry after the Japanese occupation was largely destroyed in the struggle for independence in 1948 to 1949.

Though the time is long distant when sugar provided almost a quarter of the export income, as it did before 1930, the destruction of the sugar industry would have been a heavy blow to the new Republic had it not been for the boom in rubber prices with the outbreak of the Korean War. In the period between the post Korean drop in prices and the great resurgence of American business activity in the latter half of 1954, a period during which rubber never rose above 22–24 cents a pound, the real nature of Indonesia's economic position became obvious. For a country with problems of development as great as those anywhere in Asia, and faced with chronic balance of payments difficulties, the resuscitation of the sugar industry, which had exported well over a million tons of sugar annually before the war and contributed almost 7 per cent of the export income, was an obvious and desirable course of action. Moreover, though cane is grown in almost every part of Indonesia, the sugar industry is confined to Java, an island which, while absorbing the greater part of the national income, earns only about one quarter of the foreign exchange; Java needs to expand its foreign earnings to help refute the charge which is frequently made in the other islands that it is a parasite which is appropriating the national resources for its own exclusive benefit. The Indonesian Government, however, has taken little positive action itself to assist the recovery of the sugar industry.

The difficulties confronting the re-establishment of the industry after 1949

TABLE I

AREA AND PRODUCTION OF ESTATE SUGAR IN JAVA

Year	No. of estates	Harvested area (1000 ha.)	Sugar production (1000 metric tons crystal)		Sugar yield per ha. (quintals crystal)
			From estate cane	From cane purchased from smallholders	
1930	179	193.7	2915.7		152
1938	97	84.8	1400.3		162
1950	...	30.3	277.1	.....	91
1951	54	44.2	414.1	8.5	97
1952	54	46.6	434.1	22.3	93
1953	54	44.9	552.6	62.8	123
1954	55	48.9	589.7	115.7	120
1955	55	.....	851 (est)		...

Source: Statistik Perkebunan; Statistik Pertanian Rakjat; N.I.V.A.S.

were very great. The general uncertainty over the future of the foreign enterprise in Indonesia was a considerable deterrent to European companies faced with the necessity of rebuilding burnt-out mills; the situation regarding leases and rents of sugar land was obscure; the delivery of new equipment was tardy; and in many parts of Java bandit gangs continued to make depredations on company property and on growing cane. In addition to these internal difficulties the rapidity with which world sugar production had expanded was threatening to glut the market; by 1953 the familiar pre-war situation of mounting surpluses and the prospect of a substantial fall in price led to attempts at international control of sugar marketing and the International Sugar Agreement. The Agreement attempted (so far without much success) to stabilize prices, allotting "free market" quotas to its producing signatories. The sugar industry of the Netherlands Indies was always based on export markets and the likelihood of Indonesia regaining a substantial share of former markets did not therefore appear very strong; though refusing to be a party to the Agreement Indonesia has nevertheless on balance benefited by it, and has provided a further example of the tendency for restrictive agreements to benefit outsiders. However, as Java carried an enormous burden in the pre-war restriction schemes of the 30's—a policy in which few Indonesians were consulted—Indonesia can fairly claim a measure of economic justice. In the face of declining or restricted production of most other cane producers Indonesian output has increased rapidly. By 1955 the pre-war sugar output had not been regained, but its realization did not appear far distant, as can be seen from Tables I and II. The present level of sugar production is still less than one-third of the 2.9 million tons produced in 1930, the high water mark of the industry, and room for further expansion

TABLE II

SMALLHOLDER CANE IN JAVA

Year	Harvested area (1000 ha.)	Sugar production (all kinds) (1000 metric tons)	Sugar yield per ha. (quintals crystal)
1931	8.7	53.8	62
1938	12.1	91.2	76
1950	8.5	.....	..
1951	16.5	117.2	71
1952	21.6	182.2	68
1953	22.3	202.8	75
1954	27.7	198.4	72

Source: Statistik Perkebunan; Statistik Pertanian Rakjat; N.I.V.A.S.

is therefore considerable, though it would not appear that an output of this magnitude is at all probable in the foreseeable future.

STRUCTURE AND LOCATION OF THE SUGAR INDUSTRY

There are a number of very distinctive features in the Indonesian sugar industry which contrast markedly with those of other cane producers and also with other large scale agricultural activities in Indonesia itself. The most important section of the industry by far is that of the so-called "estates" (Perusahaan Perkebunan) though in fact the estates own no land. Indigenous farmers' and small landholders' cane (Tebu Rakjat) has always made a small contribution and in recent years small holder cane growing has expanded considerably; nevertheless it accounted only for one-fifth of centrifugal sugar production in 1954. The estate industry is entirely non-indigenous in ownership and management, but while other estate industries such as rubber, copra, palm oil, tea, etc., include considerable British and occasionally American and other foreign capital investment as well as Dutch, the foreign sugar companies are virtually entirely Dutch owned. The balance of the estate industry which is not Dutch controlled is solidly in the hands of the Chinese. The Chinese have been engaged in the production of sugar in Java from the earliest years of the Dutch East Company, and can be regarded as the founders of the industry. The Chinese have never been entirely displaced by the European companies, and at present with the destruction of many Dutch owned mills the Chinese share of the industry is somewhat greater than in 1939. Largest of the Chinese sugar interests is the Kian Gwan Company which operates ten mills on the north Java plain, and is part of the Oeei Tiong Ham concern which has wide ramifications throughout Southeast Asia in trade, shipping, and banking.

The location of the industry is also in striking contrast to that of other estate industries in Indonesia. Of the 1.8 million hectares of all estate land in Indonesia only about one-third is located in Java, and of this almost one-half is located in the Residencies[1] of Djakarta, Bogor, and Priangan in the Province of West Java (Fig. 1). But apart from 5000 hectares in Tjirebon Residency in West Java the 49,000 hectares of estate sugar in 1954 were entirely confined to the Provinces of Central and East Java. Climate largely dictates this pattern of sugar cultivation in Java; sugar requires a definite dry season and thus does not extend into West Java, where, though the months from April to October receive distinctly less rainfall than the rest of the year, a dry season can scarcely be said to exist; the Tjimanuk is thus the effective western limit of cane cultivation, though at present very little cane is grown west of Tjirebon city itself. Even in central Java the dry season is not really strong; it is strongest in the north coast plain. Only in East Java is the dry season well marked, its severity generally increasing eastwards, being of as much as six months' duration on the coast of Besuki north of the Idjen. East Java, including the Residencies of Madiun, Kediri, Malang, Surabaja, and Besuki, is thus the most important by far of the three Provinces for sugar production and in 1954 accounted for 65 per cent of the estate output compared with 27 per cent

[1] The old Residencies have no real administrative function, though statistics on a Residency basis are still collected. The units of Local Government are the Kebupaten (Regencies) and the Propinsi (Provinces). The whole structure of Local Government is still confused and obscure; some parts of Java are administered as Special Territories (Daerah Istemewa), e.g., Jogjakarta.

for Central Java, the balance coming from Tjirebon. These proportions do not differ greatly from those of 1930 or of 1938, so that the fluctuating fortunes of the sugar industry have not affected the three Provinces very differently.

Nevertheless, there have been considerable changes in the location of the industry which are concealed in the above statement; the present distribution of commercial cane cultivation is determined by the survival or reconstruction of mills. In those parts of Java where the fighting in the war of independence was severe the gutted shells of former mills are a common sight. Other dilapidated and overgrown ruins can be seen throughout central and east Java, their former nature being indicated by the remains of *djalan lori* (Decauville track) used for cane transport; these represent mills abandoned in the great depression of the 30's. Outstanding is the daerah of Jogjakarta, the seat of the Republican Government during the revolution. In the fighting every mill in the Jogja area was destroyed. In 1931 there were 17 in operation; by 1938 their number was reduced to ten of which seven were actually in operation. The evidence of this long decline and fall is to be clearly seen in both the countryside and in the city of Jogjakarta itself, where the wrecked equipment of the former mills now constitutes the raw material of state-owned Pedjebit ironworks, one of the largest in the country. This works was originally constructed to service the sugar mills in the Jogja area; now the heavy lathes that were installed to deal with the massive rollers of the mills are used to produce metal household utensils, vises, presses, rubber mangles, and other metal equipment for migrants to Sumatra. The renewal of commercial cane cultivation on a large scale in the Jogja is thus dependent on the completion of a new mill now being built for the Sultan of Jogjakarta with equipment and technicians from Eastern Germany. In Madiun and Surabaja there was also considerable physical destruction, but in these areas recovery has been fairly rapid. Another area from which the industry has disappeared is south central Java; i.e., Banjumas and Kedu, but here it never recovered from the depression

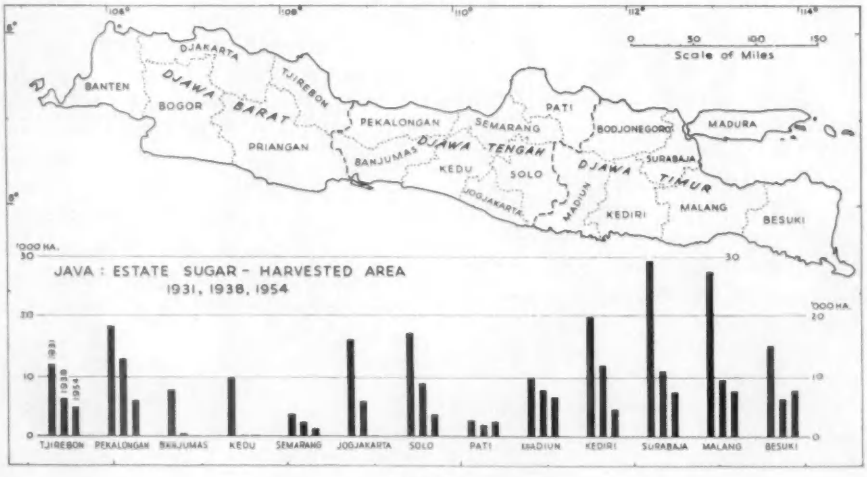


FIG. 1.

and the pre-war production was small; moreover the lack of a well-defined dry season made the area climatically marginal. Where there was comparatively little fighting in 1948–49 and where civil disturbance has since been slight the industry has made the greatest recovery; thus in Malang and Besuki estate production in 1954 exceeded that of Surabaja Residency which before the war was always the leading producer. In only two Residencies is estate production now above the level of 1938. These are Pati (formerly Japara-Rembang), now close to the 1931 peak, where there has been a considerable extension of cane growing in the plains south of the Murjo volcano, in which the enterprising Kian Gwan Company has taken a major part; and Besuki, where isolation brought freedom from disturbance and an opportunity to benefit by the elimination of other producing areas.

The organization of the estate industry is not significantly different from that of the days of the Dutch administration, the most important changes being in sugar disposal. The most distinctive feature is that the Companies, or "Estates," own no land, a consequence of the Agrarian Law of 1870 and the Land Rent Ordinance, which while prohibiting the sale of land to non-indigenes made provision for the leasing of land to Europeans and others under certain safeguards. In the lightly populated Outer Islands unoccupied land was made available to estate companies by the Government on long leases (erfpacht) and concessions, but in densely populated Java this was not possible. Sugar companies thus make contracts for the hire of village lands, which may be of short or long duration. Short contracts may run for up to 3½ years and long contracts for up to 21½ years; short contracts cannot be made more than 15 months ahead of the proposed commencement of cultivation and long contracts not more than 30 months ahead. The purpose of this regulation is to discourage villagers from using the rentals from estates as a form of credit, a difficulty with which the Netherlands Indies Government struggled without success. In the past estates undoubtedly obtained land at low rentals by exploiting the *tani's* chronic shortage of cash—the further ahead the lease was negotiated, the lower the rent.[2] Otherwise there is complete freedom for both parties in negotiating rents for short term contracts but minimum rents are laid down by the Government for long contracts, and these are subject to periodic review—rent regulations have been made annually in recent years.

A further provision of the former Dutch administration which has been preserved arises from the fact that all estate cane is grown on sawah (padi) land, but rice is Java's principal crop, of which it has never really had enough; accordingly not more than one-third of the total village sawah land may be planted to sugar at any one time. As cane is in the ground for a period of a year to 18 months it thus forms part of a three-year rotation with rice, and other crops such as sweet potatoes, cassava, ground nuts, soy beans, etc., collectively known as *polowidjo*. By this means competition for land between sugar and food crops is minimized. The cycle of cultivation involving the rotation of crops and the virtual absence of ratooning makes Indonesia unique among cane producers.

During any wet season two-thirds of the sawah land is under rice. Unlike the "colono" system of the Caribbean, or the tenant cultivation in the Philip-

[2] For a discussion of this point *vide* J. H. Boeke, *Structure of the Netherlands Indies Economy*, 1942, p. 80, also K. J. Pelzer, *Pioneer Settlement in the Asiatic Tropics*, 1945, p. 172.

TABLE III

THE CYCLE OF CULTIVATION IN THE JAVANESE SUGAR INDUSTRY

(Village Sawah Land)

	First	*Second*	*Third*
Dry Season—1956	Planting of cane (May–July)	Harvest of old cane (June–November)	Polowidjo
Wet Season—1956/57	Cane	Rice	Rice
Dry Season—1957	Harvest of old cane (June–November)	Polowidjo	Planting of cane (May–July)
Wet Season—1957/58	Rice	Rice	Cane
Dry Season—1958	Polowidjo	Planting of cane (May–July)	Harvest of old cane (May–July)
Wet Season—1958/59	Rice	Cane	Rice
Dry Season—1959	As for 1956		

pine industry, the estates produce sugar themselves on the rented land, and employment is available for individual owners, or villagers where the land is communally held, as cultivation hands. In effect the "tenant" thus becomes the landlord. The system is undoubtedly open to abuse, but it is extremely efficient and yields of sugar per hectare are very high. Before the war Java had the highest yield of sugar per unit area of any cane producer, and even at present it is exceeded only by Hawaii and Peru. The length of time cane is in the ground depends upon the variety planted and upon weather conditions; 12–14 months is a common duration but high yielding varieties like the famous P.O.J. 2878 may be in the ground for 16 months or longer. A selection of varieties maturing at different periods enables a longer crushing season and lowers costs, and estates therefore plant up to three or four varieties where possible; resistance to pests and infection is also minimized.

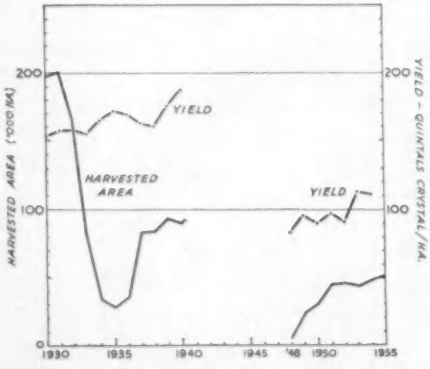


FIG. 2. Harvested area and yield of estate sugar in Java, 1930–1955.

Smallholders' cane can be divided into cane grown under contract for processing at a company mill and cane processed in simple domestic equipment. Non-centrifugal sugar of this type, or *gula Java*, is confined to local consumption and competes with a number of other sources of sugar such as the Palmyra palm (Borassus flabellifer). Owing to the different periods of time that cane and padi occupy the ground and their different water requirements smallholders have usually found the growing of cane on sawahs difficult. Where smallholders grow cane on sawah land it is planted in the dry season for cutting the following year, followed, if the harvest is early enough, by polowidjo, and in the following wet season by padi. In the past, therefore, most smallholder cane was produced by dry fields (tega-

lan), leaving the sawahs for food crops. But in some areas the capacity of reconstructed mills exceeds estate production and smallholder cane is now eagerly sought after, though its sugar content is considerably below that of estate cane. Political changes, too, have favored the expansion of smallholder production. Thus since 1950 there has been a considerable expansion of smallholder cane on sawahs; in 1954 almost 16,400 ha. of sawah land was planted to smallholder cane, almost double the pre-war area, while the 11,500 ha. of dry field also exceeded that of 1939. The total area of sugar cane grown by Indonesian farmers is almost certainly much larger than these figures indicate, but though grown by every Javanese village for chewing, smallholder cane for crushing at a modern mill is quite restricted in distribution. In 1954 the Residencies of Madiun, Kediri, and Malang accounted for 62 per cent of the smallholder sawah cane (cf. 38 per cent of estate cane), while Kediri alone possessed 67 per cent of the dry field cane.

The conflict of land use, though reduced by the lease system, is nevertheless a real one. Despite the upward trend in rice production since 1950 to a level now well above that of 1939, there is a chronic rice shortage in many parts of the country and Government refusal to make available foreign exchange for rice imports while permitting importation of many semi-luxuries is a source of continued irritation to many Indonesians.[3] For the first time since 1950 rice output in 1955 showed a decrease on the preceding year of some 7 per cent due to unfavorable weather. The 50,000 hectares of estate cane represent only about 1.3 per cent of the total sawah area of Java and Madura, but the productivity of these sawahs is considerably above the national average, and it is in the local rather than the national setting that the issue should be judged. As Robequain has pointed out, sugar cultivation has affected all the best sawahs in that part of Java suitable for cane growing.[4] An official of a large company interviewed expressed the view that the operations of the companies involved no conflict of land with food crops, but that this was true of smallholders whose productivity was much lower and who employed a two- as opposed to a three-year rotation. It was added, moreover, that because of the heavy use of fertilizers on cane grown by the companies and their exacting standards of cultivation, the productivity of sawahs leased for sugar was greater than if rice alone were grown. The considerable growth of smallholder production suggests that cane growing is a profitable operation at present, but whether the tani who leases his land to a company would be better off if he could afford to forego the rent payment and cultivate the land himself (which was frequently the case before the war) the writer found difficult to decide; not unexpectedly it is denied by the companies, on arguments similar to the above.

Inseparable from the conflict of land use is the conflict for water; both rice and cane need irrigation water, for though not essential for cane it is an important factor in the high yields obtained by the estate industry. In the early stages of growth, water is often poured over the plants by hand; later it is distributed over the field by a system of rectilinear ditches (*got mudjur* and *got malang*) which are made during the preparation for planting. Estates pay for irrigation water while farmers do not, its cost being included in the land

[3] Foreign exchange for the import of 500,000 tons of rice is to be made available in 1956.

[4] C. Robequain: *Le Monde Malais*, 1946, p. 368, translated E. D. Laborde, as *Malaya Indonesia and the Philippines*, 195.

tax, and, in the past, estates have attempted to claim a priority when water has been short. However, the *waduk* or reservoirs which were constructed before the war to serve the sugar areas have a capacity much in excess of the demands of the industry at present, and in recent years Java, like much of Asia, has experienced an excess rather than a deficiency of rain. However, population pressure and a run of drier years could make the problem a serious one. Water is divided between the various sawah crops in some predetermined proportions, usually in the ratio of 4 : 2 : 1 for padi, cane, and polowidjo respectively, though varying to 2 : 1 : 1 according to local conditions and practice.

PRODUCTIVITY AND EFFICIENCY

The productivity and efficiency of the Java sugar industry has for long been very high, a necessity since the island, unlike other important cane producers, has never had a large protected or reserved market, and has had to compete on the "free" market for the disposal of the greater part of its output. Costs of production before the war were among the lowest in the world; unfortunately for Java, costs of production are of relatively little significance in the chaos of economic contradictions and anomalies that constitutes the world sugar industry. Output per man, the real test of economic efficiency, is at present below that of before the war. Indonesian competition would become acute if the opportunities for cost reduction which undoubtedly exist were realized. However, many of these opportunities depend on changes in the political and social environment over which the industry has no control.

In 1938 Java had the highest yield of sugar per unit area of cane harvested in the world; the average of over 160 quintals per hectare (6.4 tons per acre, approximately) represented a tenfold increase in productivity over that of a century earlier, when the introduction of the Culture System marked the beginning of the modern industry. Yields of estate cane are at present much below those of before the war; up to 1953 yields did not rise above 100 quintals per hectare harvested, i.e., about the same as in the first decade of this century; but since 1953 there has been a marked improvement (Fig. 2). In the meantime Hawaii, with only slightly inferior yields to pre-war Java, has stepped up productivity per acre by over 40 per cent. It is extremely doubtful if Indonesia can match this performance unless there is some considerable change in the social and political climate, which seems improbable in the immediate future.

Nevertheless, Indonesia's present yield is considerably higher than most other cane producers; many of these, too, have only recently regained pre-war yields (Philippines, Formosa, Brazil), while others show no appreciable advance or even a decline on pre-war productivity (Puerto Rico, South Africa, Fiji, U.S.A.). The high yields in Indonesia are due to the use of irrigation, heavy application of fertilizers, and the use of high-yielding varieties. The work of the Dutch plant breeders at the famous Pasuruan research station in producing new varieties with a higher sucrose content and resistance to disease was of profound importance, not only to Java but to the cane sugar industry everywhere in the world. Smallholder cane for crushing averaged only 74–76 quintals of crystal sugar production per hectare harvested before the war, but there has been no subsequent decline and present yields are well up to the former level.

The sugar estates have always been the largest consumers of fertilizers in

the Netherlands Indies and Indonesia, the only other important consumers being the tobacco estates, which in Java likewise lease land from villages. Upwards of 100,000 tons were used annually before the war, principally the nitrogenous fertilizers; sulphate of ammonia and sodium nitrate. Three applications of ammonium sulphate around each plant at successive stages of growth, totalling 4–5 quintals per hectare, is the usual practice. But costs of imported fertilizers are heavy (virtually none are produced in Indonesia itself) and the pre-war fertilizer consumption has not been regained. Other inorganic fertilizers are little used; cane unlike rice shows limited response to phosphatic fertilizers. When used, double super-phosphate is applied at the time of planting. Smallholders make negligible use of inorganic fertilizers, an important factor in their lower productivity. Buffalo manure is the principal fertilizer used, but a large application is necessary for a high return and buffalo, like most other livestock, are still below pre-war numbers. Green manuring is also practiced by smallholders, legumes such as chickpea (Cajanus cajan) being sown on the ridges between the young cane plants, and turned in when the cane is earthed up.

The introduction of progressively higher-yielding varieties of sugar cane was of great importance in maintaining the industry in a strong competitive position in the days of the Dutch administration. Thus the replacement of the widely grown variety Tjirebon Hitam (Black Cheribon) by the Pasuruan bred P.O.J. 100 raised yields from a little more than 50 to nearly 80 quintals per ha. between 1880 and 1890; the introduction of B 247 lifted sugar yields to over 100 quintals by 1910; and E.K. 28 and B.I. 52, to almost 125 quintals per ha. harvested by 1925. Resistance to disease, particularly attack from the

FIG. 3. Cane fields and irrigation channel. Kediri, East Java.

parasitic plant *serai*, was a characteristic of the new cane P.O.J. 2878. Shortly after its appearance in 1927 this famous variety revolutionized the Javanese industry, and by 1929 occupied over 90 per cent of the estate sugar area. But in turn it tended to become superseded by still newer varieties and by 1939 its proportion of the total estate plantings had fallen to 70 per cent. In addition to the variety 2878, estates at the present plant the newer P.O.J. varieties 2967, 3016, and 3067 and H.V.A. 124. But like many other of the specialized scientific services in Indonesia, the Pasuruan station has virtually ceased to function since 1950, and Java is out of the running in the constant search to reduce costs through the activities of the plant breeder.[5] It is vitally necessary if the Indonesian sugar industry is to regain its former competitive position that research services with an adequate budget and sufficient trained personnel be provided for the industry. The same could be said, however, for all the other plantation industries of Indonesia.

The lower productivity per hectare harvested in the estate industry at present can be partly explained by

[5] For some unexplained reason there is also a tendency in many parts of the world for the yields of a variety to decline with the passage of time; a high turnover of varieties is thus often desirable.

unfavorable seasons, but in the main is undoubtedly due to the changed social and political environment. This problem is common to other estate industries of the country, all of which have lower output and productivity than before the war. Estate labor is highly unionized, in itself a desirable development, but Communist influence is strong and labor too often works hours which are insufficient to keep processing machinery operating at full efficiency. Output per man is difficult to estimate with a large number of seasonal workers, but the output per man in Javan sugar mills is probably no more than one-tenth that of Australian mills in Queensland. While the unions continue to regard themselves as in the vanguard of the fight against the vestiges of "colonialism," i.e., the foreign companies, it is unlikely that efficiency can be greatly increased.

SUGAR DISPOSAL

Like most cane producers, the bulk of the pre-war production of Javan sugar was destined for the export market; domestic consumption was only a little over 200,000 tons and per capita consumption was one of the lowest in the world, only 4.5 kg. per annum. Unlike that of most other producers Javan sugar was exported in the refined as well as the raw state, although at present this practice is becoming increasingly common. Asian countries have always been the best markets for Javan sugar, though small amounts reach Europe from time to time. At present the industry is still mainly dependent on the domestic market, though exports have increased rapidly. Up to 1953 exports were small. Indonesia refused a quota of 150,000 tons offered by the International Sugar Council, and requested a quota of 450,000 tons on the basis of its pre-war export of over one million tons. This was rejected by the Council and Indonesia has, therefore, failed to join the International Sugar Agreement which is to operate until 1959. By rationing home consumption in conjunction with the growth of output, substantial quantities of sugar were made available for export while other producers have accepted quota reductions. In 1953 exports rose from less than 2000 tons to over 100,000 tons; in 1954 there was a further increase to over 220,000 tons, and for 1955 exports are estimated at over 400,000 tons. Brazil, another non-signatory, has also managed to increase its exports substantially. Japan has been the largest buyer of Indonesian sugar and has negotiated for the purchase of 200,000 tons of Java raws for 1956. Other important buyers have been Burma, India, and Thailand. A significant development has been the purchases of Eastern Bloc countries, particularly China, which was the largest buyer after Japan in 1955. A not unlikely development is the purchase of Indonesian sugar by the U.S.S.R., which has recently been a substantial buyer on the world market. Increased trade with the Communist world seems inevitable, however, and the present Prime Minister, Ali Sastroamidjojo, has already stated its desirability. Since 1954 the export trade to Asia, as well as the domestic trade, has been reserved to Indonesian nationals, which has meant in practice that the Chinese dominance of the sugar trade has increased substantially.

Indonesian domestic consumption while absorbing rather more than half of the current output is still very low, and the pre-war per capita consumption has only very recently been regained. Allocations to the home and export market are made by the sugar producers' syndicate N.I.V.A.S. (Netherlands Indies Sugar Producers Syndicate) which acts as the agent of the Government.

There is undoubtedly scope for a very substantial increase in the domestic consumption. This largely arises from the very high internal price of sugar in Indonesia, 3.3 Rp per kg. (about 15 cents per lb.), which is very substantially above the world price; a reduction in the various taxes on sugar could bring about a substantial increase in local demand.

PROSPECTS

The sugar industry in Indonesia has recovered at a rate that hardly appeared possible in 1950, and at the present Indonesia does not find it difficult to dispose of the whole of its expanding output. But Indonesia cannot hope to enjoy immunity from the world problem of overproduction forever. Opportunities for a reduction of costs exist, though it may not be possible to realize them; unfortunately the balance of cost advantage is seldom a telling factor in the world sugar trade. With the increasing tempo of economic development in Asia and an increase in Asian incomes there should, however, continue to be a strong demand for Javan sugar, and the geographic advantages of the island are considerable. It is highly probable, however, that if Indonesia became burdened with a large sugar surplus the interest of Communist buyers would be sharply heightened. In such a situation Indonesia could act no differently than other Asian countries already faced with this problem.

BOOK REVIEWS

Asia East by South: A Cultural Geography, by J. E. SPENCER. x and 453 pp.; 4 plates, 136 maps, diagrs., bibliogr., index. John Wiley & Sons, New York (Chapman & Hall, London), 1954. $8.50. 11 x 8½ inches.

Some geographers will find this an unsatisfactory, even perhaps an annoying, book. But at least it is a book and not that sterile bastard, a "text": the author has a personality and puts his personality into his writing, which is the only way to write a book. This note is struck right away in the Preface by the assertion that the geographer of Asia will be compelled to take into his reckoning many intangibles of history and culture. This reviewer would heartily endorse every word of Spencer's first two paragraphs. In the working out of this principle there are many things that he would as heartily not endorse, but then that is one of the merits of *Asia East by South*. Repeatedly one snorts in the margin and feels an ardent desire to argue with Spencer, and this not just on the architecture of Bombay (a veil over this topic, please!) and the *mores* of Europe in the East, but on such essentially geographical and geographically essential matters as the use and abuse of the word landscape (which suffers the most extraordinarily diverse fates in Spencer's pages), the question of what is a system of agriculture, the theory of regionalism, and whether we may expect regional differences to become more or less pronounced with economic evolution.

The structure of the book is straightforward. The first 170 pages are systematic, including, however, besides the standard discussions of structure (not crystal-clear this), climate, soils, vegetation, and so on, chapters which are essentially historical sociology—on religion, the structure of society, cultural tradition and contact. Perhaps these things are not always married to the regional geography with the closeness that could be wished for a happy marriage, and the extent to which Spencer deals in them may well be anathema to the purists of "this-is-not-geography." But if there are people who think that intelligent regional geography can be written without very much attention to such topics, they had better not try their hands on the geography of Asia. One of the best chapters in this section is that on "Settlements and Their Architecture," treated *con amore* and with a fascinating range of detail.

The rest of the book, apart from a handy country-by-country statistical section and very useful bibliographies, is regional. Here one's chief complaint is that the scale wobbles excessively. This is of course extremely difficult to avoid; nevertheless 37 pages for India, Pakistan, and Ceylon together seems inadequate when Burma, Thailand, Indochina, and the Philippines get 16 pages each. Thus, while there is some good critical evaluation of current problems and policies in Thailand (some good points here on the disadvantages as well as the advantages of not having been a colony) and the Philippines, there is not only no clear picture of India regionally, but to all intents *no* reference to the tremendous activity (whether it will be successful or not) in India today. Indeed the references to Indian trade and industry seem well behind the times.

Ceylon is especially unlucky. In general Spencer obviously holds that history is as necessary to geography as vice versa—in which this reviewer is entirely at one with him. But for some odd reason, all the odder in view of his generally sound historicist approach, Spencer seems almost to hold a grudge against Ceylon for not being politically a part of India. But if geomorphologically it is but a fragment of the Peninsula, in other respects—and not only religion and culture—it is very distinctive. Despite the importance of the Tamil contribution, the "quirk of history" of which Spencer speaks (p. 199) is not that it is separated politically from India, but—as with Burma—that it ever was administratively Indian, as it was for two or three decades after 1796. The upshot is that Ceylon, an independent Dominion of considerable importance in the Asian world, gets about 16 lines (including half-lines misleadingly lumping it with India) scattered through some 20 pages, as compared with a solid 21 lines for the single Ilocano region in the Philippines.

This disproportion is perhaps the only serious organic flaw in the book. As in any work of its size and range, there are quite a few more superficial flaws. But against these we must put many merits. For Spencer at his best we might mention the description of Burmese agriculture or the first of the Chinese chapters. One good point is the attention paid to the *raison d'etre* of internal political divisions, an aspect of regionalism as rewarding as neglected.

Many of the maps are more informative than

they look at first sight, though the wiry line used is sometimes annoyingly difficult to follow—for example, railways and rivers are almost indistinguishable in Figure 108. Some of the maps of regionalisms (e.g., Figs. 17–20, 40–43) are nothing but a few thin, lonely lines and vast open spaces of blankness; what is the use of these unless some clue to the criteria used is given, so that even if the author doesn't discuss them the reader could think about them? The never-sufficiently-to-be-banged-on-the-head American laziness of not giving a list of figures is faithfully adhered to.

It might be unfair to describe the writing as American Academic—there is not enough jargon, and its faults are its own, except for a positively wicked exaggeration of the A. A. trick of invariably invertedly positioning the adverb. There are some odd usages: recovery is aggravated (p. 158), "endless in limitation" (p. 159—why not just "limitless"?), prediction of a date around 2000 B.C. (p. 173—there may be a more legitimate meaning here but the confusion is avoidable), a wall personifies features (p. 308). Granted the difficulty of finding a convenient term to distinguish the Indian sub-continent from the Republic of India, surely to use "united India" for the former is a desperately unlucky attempt at escape, leading to such curiosities (pp. 193–199) as "united Indian rice," the scattering of "united Indian industrial locations," the "Government of united India" giving Colombo added facilities (!), "united Indian participation in the jute industry" (!!), and—wonderful climax to the u. I. congeries of adjectives—"the modern urban united Indian silver and gold craftsman." This reviewer hostilely also reacts (as Spencer would put it) to the use of "British" for Australian New Guinea. Colonialist! But though there is perhaps more clumsiness than felicity, some obscurities, some trite filling-in remarks, there are also many pages of clear exposition, an occasional effective use of colloquialism, an occasional really happy phrase—e.g., "the accumulated cultural weight of Hinduism" (p. 125), which hits the point exactly.

Despite the blemishes, and the list of slips, errors, misleading or inadequate statements which could be compiled, on balance the merits of the book greatly outweigh its usually very minor failings. Its sub-title is *A Cultural Geography*, and the judicious student will therefor not go to it for what it does not profess to give—the *detail* of geomorphology and soil and climate (the *fundamentals* are there). But *Asia East by South* not only presents a generally very sound factual survey of the cultural geography of a large and extremely important section of the world, Monsoon Asia; it expresses, and sometimes forcibly, a point of view which, in its broad outlines, is probably that most generally acceptable to reasonably objective students of the Asian scene. "Recommended."

O. H. K. SPATE

Australian National University Canberra

Plant Location in Theory and Practise, by MELVIN L. GREENHUT. xiii and 338 pp.; diagrs., index, bibliogr. University of North Carolina Press, Chapel Hill, 1956. $7.50. 9 x 6 inches.

Research students in economic geography usually find it desirable to rationalize their hypotheses in terms of models produced by writers in the field of economic theory. In the geography of manufacturing, they have been prone to follow either the approach popularized by Alfred Weber (et al.), which emphasizes individual locations, or the market-area approach, most completely developed by August Lösch. The present volume provides geographers not only with a good historical and analytical statement of present-day versions of those somewhat divergent approaches, but also presents a workable plan for harmonizing them into a single, unified body of theory. Students will find in it the most compact and accessible statement of the application of modern economic theory to problems of industrial location that has appeared in recent years.

As in virtually all treatments of the economics of location, Greenhut's analysis proceeds from the general assumption that economic behavior is mainly to be explained in terms of the pursuit of economic gains and that the selection of industrial locations is one of the products of the search for maximum profit. He shows the relationships between areal variations in costs, on the one hand, and in selling prices, on the other, and examines the impact of a variety of phenomena such as transport costs, labor, pricing policies, demand characteristics, and numerous other cost-and-price elements on areal variations in prospective profits, and therefore on site selections. Readers who desire a rapid review of the impact of recent trends in economic thought, particularly the introduction of concepts of imperfect competition into the models, will be pleased with the relative simplicity of Greenhut's presentation.

There are, perhaps, chapters in which the presentation becomes a trifle too involved to be followed with ease by the reader who is not accustomed to the procedures employed by the economic theorist. There are times when one feels that too much attention is being given to elaboration of the hypotheses and not enough to questions as to whether they can, in fact, be tested with the kinds of data that are or might be made available. It is clear, however, that the purpose of the volume is not to provide the reader with a do-it-yourself kit for analyzing

actual geographic situations, but rather with providing him with a basis for evaluating the myriad of forces that are functioning to produce those situations. For this latter purpose—the better formulation of locational hypotheses—this volume is an excellent guide.

H. H. McCARTY

The State University of Iowa

The Forest Area of the World and Its Potential Productivity, by STEN STURE PATERSON. Paper covered book, 9½ x 6½ inches, 216 pp.; world map in color in separate folder, 11½ x 8½ inches, same title. The Department of Geography, Royal University of Göteborg, Sweden. (Distributed by the author.)

This is a very scholarly study in which an attempt is made to estimate the future productive capacity of the present productive forest areas provided that proper forest management is completely carried out. The author includes the entire world in his area of research and uses a variety of statistical tables and maps to support his work. He introduces the term "climato-isophyte" which he defines as a line connecting places with equal plant growth ability, resulting from climate, expressed by the CVP–index. There are maps of each continent showing climato-isophytes at 1 : 50,000,000 (Europe 1 : 30,000,000). Concerning the CVP–index the author says (page 68): "temperature, precipitation and light are the three climatic factors most important for the life process of plants. From these factors it should consequently be possible to obtain a value for the plant growth ability of a climate . . . this number should have a constitutional relationship with the value of ideal site class. Thus the index should be an expression of the productivity of vegetation caused by the climate. Because of the intimate connection between climate, vegetation and productivity, the index has been called the CVP–index after the initials of the three words."

Many pages of statistics are marshalled as a base for the climato-isophyte maps. These, in turn, are the basis for a small world map of productivity regions. A considerable part of the book discusses present forest distribution and there is a world map (1 : 30,000,000) showing the forest area of the world on which the forests are shown as accessible, inaccessible, and others. The forests are shown in the form of squares or rectangles the size of each expressing the number of hectares involved. The forests are not broken down into types.

Diagrams show the relation of area to volume for each productivity belt in the various parts of the world. It is also shown that the actual productivity is always a great deal less than the potential productivity. An interesting summary with prognosis concludes the book.

The above mentioned items are only hints at what this book contains and, as it is written in a clear and simple style and contains an extraordinary wealth of ideas and information, the author certainly has made a valuable contribution. All those interested in forest productivity, present and future, will find this book an important addition to their library.

This reviewer is, however, not persuaded that the story is quite as simple as it is presented, all the described complexities notwithstanding.

The author speaks repeatedly of site and site classes. As everyone who has worked with the problem of site knows, we have here a very large number of extremely difficult problems to deal with and, so far, no successful approach has been discovered. Site relations vary from one species to the next, but the author is satisfied that in his discussion species may be ignored. Site qualities are furthermore characterized by frequent changes within the shortest distances and to generalize them to very small scale proportions where vast areas are involved strike this reviewer as unrealistic.

Another point in question is that the author attempts to base his work on climate, although he quotes Livingston and Shreve who demonstrate in the quoted book that climate cannot be considered as a sole basis.

Finally, the author deals with future productivity of forest areas. One reason such speculation must remain inconclusive is that we are only now beginning to succeed with forest genetics. This means through genetics we are now producing trees that will grow faster, resist diseases and pests, react differently to site qualities, etc. In other words, the future is sure to bring about fundamental changes in forest productivity and to make a prognosis on the basis of climate alone leaves much to be desired. Yet, Paterson's book is without question a thought-provoking piece of work that all interested in forest productivity should be acquainted with.

A. W. KÜCHLER

University of Kansas

Forest and Range Policy: Its Development in the United States, by SAMUEL TRASK DANA. 455 pp.; index, bibliogr. McGraw-Hill, New York, 1956. $6.50. 9¼ x 6½ inches.

To Francis Bacon's dictum, "Some books are to be tasted, others to be swallowed, and some few to be chewed and digested . . . " we might add: Some are to be skimmed to determine the content and then placed on the shelf to be used regularly for reference purposes. Samuel T. Dana's *Forest and Range Policy: Its*

Development in the United States is of this latter category. Its fundamental usefulness will be for reference purposes. The author, who is Dean Emeritus of the School of Natural Resources of the University of Michigan, has written a straightforward, sober, and prosaic history of American forest and range policy.

A volume on the history of development of American forest and range policy might be an exciting, stimulating, and provocative work. It could record the clash of interests and personalities in the legislative formation of policy. It could show the effect of irrelevant political considerations on policy development, and trace the influence of a changing political and social philosophy in the minds of the American electorate on natural resource policy. It could point to current unresolved problems and indicate the type of research needed to allow us to make rational decisions about them. Dana has chosen to do none of these things. He has contented himself with a dispassionate, careful, and encyclopedic account of the legislative steps and the public events that led to past and present forest and range policy in this country. It is this systematic and encyclopedic coverage that makes the book so useful for reference. It is one of a group of similar encyclopedic compilations that have been appearing in recent years. One thinks in this connection of such books as Sampson's *Range Management: Principles and Practices* (reviewed in ECONOMIC GEOGRAPHY, Vol. 29, 1953, p. 89) dealing with physical aspects of range management. Sampson, like Dana, is an emeritus professor who has written an encyclopedic book; not indicating much about current problems in range management, but covering what is known in exhaustive detail.

Forest and Range Policy is not a book of general interest or utility. But geographers actively engaged in research and specializing in North America or in resource management will find it a handy and useful reference to have available.

WESLEY CALEF

University of Chicago

Conserving American Resources, by RUBEN L. PARSON. x and 550 pp.; maps, diagrams, ills., index, bibliogr. Prentice-Hall, Inc., New York, 1956. $8.65. 9 x 6 inches.

In his textbook, *Conserving American Resources*, geographer Ruben Parson, writes from long experience as an educator and as a student of man's utilization of resources. The style is highly personalized and therefore often provocative, yet in the main avoids partisan extremes and the over-statements that usually accompany efforts to popularize this serious and complex subject. However, the author is forthright in expressing his convictions and they are found throughout the book.

The organization is logical, and emphasis is on evaluation of practices and policies in resource utilization. The author wisely makes almost no attempt to include the subject matter of resource geography as is often done in books entitled conservation. In chapters one and two he presents the case for conservation study by all citizens, outlines his point of view, and clearly expresses the need for man to reconcile his actions with the ecological unity of the environment. Chapters three and four present fundamental concepts about water and soils as the basic attributes of land resource. Chapter five then introduces and evaluates the concept of land capability as the criteria for rational land utilization and planning. There follows a series of eleven chapters dealing with conservation of the specific resources—water, soils, forests, grasslands, wildlife, recreational assets, fisheries, and minerals. Chapter seventeen, "Prospects and Responsibilities," recapitulates the need for conservation and offers a number of suggestions for achieving a higher level of conservation practice. Numerous sketches and drawings give valuable pictorial emphasis to principles presented in the text. An appendix includes some useful suggestions for the teacher, a list of conservation organizations, a bibliography, and selected film suggestions.

This treatment of conservation is notably well balanced and avoids the all too common fault of the negative approach. Professor Parson appears as an optimist affirming a steadfast belief in the ingenuity and ultimate common sense of man. Thus he writes, "Let the conservator rather than bemoaning future shortage, encourage timely research to circumvent or alleviate its consequences" (p. 445). Throughout the book he makes it clear that conservation lies in utilization of resources and in practices that do more than just maintain existing levels of productivity. At the same time the essential need for compromise between the technically possible and the economically practical level of conservation practice is recognized. There is no clear-cut attempt to appraise the ideological conflict of public ownership versus private enterprise as it effects conservation. However, in several places the role of government is noted as chiefly one of research and regulation for protection of the public interest. In the discussion of recreational resources Parson strongly champions public ownership. There are some inadequate statements which may be misleading but remarkably few errors.

The book should be well received by college students. Considered in context with the author's purpose it is a worthy contribution to the textbook literature.

J. GRANVILLE JENSEN

Oregon State College

Oxford Regional Economic Atlas: The U.S.S.R. and Eastern Europe. Prepared by the *Economist* Intelligence Unit and the Cartographic Department of the Clarendon Press. viii and 134 pp.; index. Oxford University Press, New York and London, 1956. $10.00 (38s. net). 10 x 7½ inches.

This is one of the most important reference works on the USSR to be published within the last two decades. Its 50-odd maps, tables, and text constitute a concise review of the accomplishments of Communism in the Soviet Union, in its East European satellites and in Yugoslavia, as seen in the mid-1950's. To the specialist, to the student, to the intelligent reader, this slim volume becomes indispensable as a source of basic statistical information, precise cartographic representation, and authoritative reference to most economic aspects of the Soviet world.

The volume falls into three major divisions. The first, introductory section provides a highly useful set of location maps on scales varying from 1:4 million (East Germany and Poland) to 1:19 million (Siberia), for the USSR and its satellites. The second section establishes the physical background of economic life in the Soviet world, through basic cartographic information on geology, relief, soils, vegetation, and climate. The third, most important, and most original section deals with the economic life of the USSR and of Eastern Europe, in terms of agriculture, fuel and power, mining, manufacturing, and transportation. This section consists of a combination of maps and text. The maps, some dot maps, others simple distribution maps using symbols for major mining or manufacturing center alternate with pages of text, these latter in turn consisting of concise statements of the historical background, of current developments, and of future plans, generously interlarded with statistical tables.

The transportation section, maps and text, deals with railroads (showing in separate symbols the Soviet accomplishments in this most important branch of the Soviet transportation system); roads; waterways and ports; and airways. There is an excellent population dot map, showing major cities, and giving population estimates for these as of 1954; an ethnographic map of the USSR and of Eastern Europe; and three historical maps that show Russian territorial changes between 1462 and 1955, and territorial changes in Eastern Europe between 1877 and 1955. There is, finally, a brief discussion of industrial plans and progress in the USSR, brought up to 1954; a review of industrial developments in the European satellites of the USSR; and an interesting discussion of Soviet and satellite foreign trade.

The gazeteer includes not only the most recent population figures for cities and towns of over 50,000, but gives a capsule review of the mining and manufacturing activities of each.

In a volume of such complexity, covering such a variety of matters statistical, the outstanding characteristic to be noted is the remarkably complete image of the USSR and of its satellites in Eastern Europe. There are, to be sure, some omissions and some overestimates, which is not surprising in the case of a country so notoriously reluctant to release any current information on its economic life. Thus it is easy to understand the omission of the uranium mines near Pécs, Hungary, since they did not become known until the Hungarian revolution of October, 1956. The publication, in 1956, of a series of economic statistics released by the Soviet government ("The National Economy of the USSR—a Statistical Compilation," Moscow, 1956) now provides us with a valuable Soviet counterpart to the "Oxford Atlas."

The only criticism that can be brought up about the design of the atlas, and it is a minor one, is the fact that it does not include any of the plan targets for the 1955–1960 Five Year Plan. As the book stands, it is an exceptionally valuable guide to the Soviet world, and a major cartographic achievement that will continue to serve as a basic reference work to all Soviet studies for some years to come.

GEORGE KISH

University of Michigan

Korea's Heritage, A Regional and Social Geography, by SHANNON MCCUNE. xiii and 250 pp.; maps, charts, plates, appendices, index. Charles E. Tuttle Co., Rutland, Vermont, and Tokyo, Japan, 1956. $5.00. 8½ x 6 inches.

Shannon McCune has written more than a volume on regional geography; this is also a sympathetic discussion of history, politics, and the Korean way of life. The author's repeated residence in Korea and his decades of study make this a definitive volume.

Korea's Heritage is a study of location and diversity. There are eleven chapters and nine appendices, plus numerous maps and photographs. Over half the text is devoted to the physical, human, and industrial features of the country; then follow two long chapters on geographic regions. The appendices cover 45 pages and deal with various technical items, including bibliographic references. The photographs, described in some detail in an appendix, carry a running caption which leads the reader smoothly from one picture to the next; in fact, almost before the eye has had a chance to digest the visual scene. Many of the photographs are keyed to the recent war, but the text considers fundamental aspects of the country with only passing reference to war-time problems.

To say that the volume is more of a routine description than a definitive analysis is not to detract from its value to geography. Nowhere else in English can one find such a comprehensive picture of Korea. McCune quite properly sets the population map as the key to an understanding of the landscape. "Many of the isolated parts of the northern interior have never been stepped on by the foot of man. In contrast, the agricultural lands of the south are densely crowded. . . . In some places the contrast on the one hand between the relatively evenly settled plains and hill lands and on the other hand the densely packed cities located only a few miles away is very sharp" (page 56).

In a brief conclusion, McCune comments on three geographic realities: Korea's peninsular position, its essential unity, and its geographic diversity. War-time damages amounting to some four billion dollars are being repaired, but the social and ideological shock cannot easily be measured. The closing paragraph of the book begins as follows. "The future for Korea cannot with fairness be pictured in rosy hues."

GEORGE B. CRESSEY

Syracuse University

Local Accessibility (The Hinterlands of Towns and other Centres as determined by an analysis of bus services). 2 sheets, 1:625,000. 5s. per sheet. *Explanatory Text* (No. 6, Local Accessibility), 11 pp. 9d. Ordnance Survey, Chessington, Surrey, U. K., 1955.

This set of two maps, Sheet 1, Scotland and England—North of Kendal, and Sheet 2, The remainder of England and Wales—represents one of the recent additions to the ten miles to one inch series which will eventually comprise the National Atlas of Great Britain. It is an addition of considerable interest to geographers concerned with urban and transportation studies. Building particularly on the work of F. H. W. Green in establishing hinterlands for "towns" in Britain, the Ordnance Survey has constructed two clear, readable, and graphic maps dealing with the problem of an areal division of a country into tributary regions. In this work they have avoided the arbitrary civil division frame which characterizes, and damages, similar efforts in the United States. Although Green in his work and the authors in the explanatory text for this map have both commented on the unfortunate necessity of establishing arbitrary line boundaries in instances of zonal division, these lines do represent a "watershed" rather than a political boundary.

For those familiar with the work already published on establishing hinterlands on the basis of bus services, this map will not offer any new research or cartographic techniques. Nevertheless, the presentation of a map for as large and as complex an area as Great Britain on this basis is an event of note. The cartography is truly graphic. In addition to "fixed boundaries" based on bus services, the map carefully distinguishes "interpolated boundaries" in defined "virtually uninhabited areas." The second major aspect of settlement shown on these maps is population of central places, shown by proportional circles for all places over 3000 population. These circles have a core in orange portraying the urban population and an exterior band in green proportional to the population of the established hinterland. For places with less than 3000 inhabitants several symbols are used to distinguish between those with a population exceeding that of their hinterland and those with a population which is less than that of the hinterland.

The main criticisms of this publication lie rather with the accompanying text than with the map itself. This text is adequate to explain the technique of construction if the cited references are consulted, but it fails to do more than allude to some of the more intriguing comparisons which might have been discussed. No effort is made to analyze the size of the hinterlands in population or in area other than graphically on the maps. No regional characteristics of the Midlands, the Scottish Highlands, or other areas which, on casual appraisal, appear strikingly contrasted, are cited. No explanation is offered for disconnected or excessively interrupted hinterlands. Although the map is drawn to show "fourth order zones of accessibility," that is, tributary regions of the lowest order of full trade centers (essentially Smailes' "towns"), the reader is left to wonder about (and desire) additional maps showing the hinterlands of secondary and tertiary centers, even if the hinterland of the single primary center, London, may be assumed. Similarly, the text fails to explain the somewhat dubious method of reducing major centers to their "fourth order function" and the corresponding zone of accessibility. In this manner cities such as Birmingham and London are shown with zones predicated on frequent convenience goods shopping rather than on shopping goods shopping. We cannot help but wonder how this distinction is justified. Yet criticisms of this undertaking are lessened considerably by the envy with which we must view this British publication. Much as bus services seem impracticable as a research tool for similar results in the United States, we cannot overlook our failure to produce and use a comparable technique.

J. E. VANCE, JR.

University of Wyoming

CORRESPONDENCE

To the Editor:

I am writing you concerning Professor S. H. Beaver's review of my book, *Movements of the British Iron and Steel Industry—1720 to 1951*, which appeared in the January, 1957, issue of *Economic Geography*. I not only expect but appreciate being told of errors or inadequacy of my work, but I was surprised at the tone and gross inaccuracy in content of the review of my book. I was particularly surprised since I have had correspondence with both British geographers and responsible executives in the British iron and steel industry, and they have generously praised the book both generally and in some detail.

There is, of course, no question of the right of anyone to write a review of any book in any terms he wishes. In the present instance, however, the reviewer has failed to meet any reasonable standards of accuracy and care. After comparing the review with the book, I find that as against two valid criticisms (which are welcome) at least 14 of the reviewer's criticisms are either inaccurate, out of context, or invalid. An example of each of these follows in order.

REVIEW: "Dr. Roepke seems largely unaware that in Scotland iron-smelting and steelmaking were two absolutely distinct industries—historically, economically, and geographically."

BOOK: Page 151—"Only two of the Scottish steel plants are even located adjacent to blast furnace plants; the rest are scattered far and wide in the Glasgow area and to the east and south of Glasgow. Some of them are linked with rolling mills . . ."

REVIEW: "For example, on p. 75 we read that in 1900, in S. Wales, there are 17 blast furnaces 'on the coast.' This is nonsense, but it still does not make much more sense when we are told on p. 90 that, in fact, the number 17 refers to 'iron and steel plants.' There were indeed only 2 iron-smelting plants literally on the coast—at Cardiff and Briton Ferry—and two 'pure' steel plants. The remainder of the 17 plants (almost all 'pure' steelworks) were inland—anything up to ten miles—and mostly in the hinterland of Swansea and Llanelly."

BOOK: This is very definitely criticism of statements taken out of context. Only very careless reading could have failed to grasp that the distinction being made on page 75 was between those inland plants located on or near the coal field and those on or near the coast. No attempt was made to distinguish those actually lapped by the tide from those on the other side of the coastal cities. The second reference (incidentally it should have been to page 91) is to a section which simply summarizes the earlier material and is not a new and different discussion of the topic.

REVIEW: There is in the review a long discussion of the difficulties in using the statistical subdivisions of the Iron and Steel Federation and of the diversity within some of the regions. There is a strong implication that the book ignored these problems. The reviewer says, "Can omnibus figures for iron and steel production in such a 'region' mean anything at all, either economically or geographically?"

BOOK: This is a particularly unexpected criticism since Prof. Beaver uses these identical regions in presenting the statistics of the industry on page 374 in the chapter he wrote on the iron and steel industry in Stamp and Beaver, *The British Isles* (Fourth edition, 1954). Since these are the only reasonably complete statistics available, the regional groupings are almost universally used by both economists and geographers. The discrepancies and lack of homogeneity in various of the regions are pointed out in my book on pages 154, 156, 163, 165.

HOWARD G. ROEPKE
University of Illinois
February 12, 1957

THE STAFF

Editor, RAYMOND E. MURPHY

Managing Editor, SAMUEL VAN VALKENBURG

Associate Editors

CHARLES C. COLBY
EUGENE VAN CLEEF
EARL B. SHAW
HENRY J. WARMAN
CLARENCE F. JONES
NELS A. BENGTSON
GEORGE B. CRESSEY
OTIS W. FREEMAN

Cartographer

GUY H. BURNHAM

CONTRIBUTING EDITORS

L. DUDLEY STAMP, London School of Economics, England

GRIFFITH TAYLOR, Seaforth, N.S.W., Australia

VERNOR C. FINCH, University of Wisconsin, Madison, Wisconsin

OLAF JONASSON, University of Gothenburg, Sweden

HANS BOESCH, University of Zurich, Switzerland

OTTO E. GUTHE, United States Department of State, Washington, D.C.

CARLETON P. BARNES, United States Department of Agriculture, Washington, D.C.

LOYAL DURAND, JR., University of Tennessee, Knoxville, Tennessee

EDWIN J. FOSCUE, Southern Methodist University, Dallas, Texas

C. LANGDON WHITE, Stanford University, Stanford University, California

CLIFFORD M. ZIERER, University of California, Los Angeles, California